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Fracture Characterization of the Large-Block Test, Fran Ridge, Yucca Mountain, Nevada

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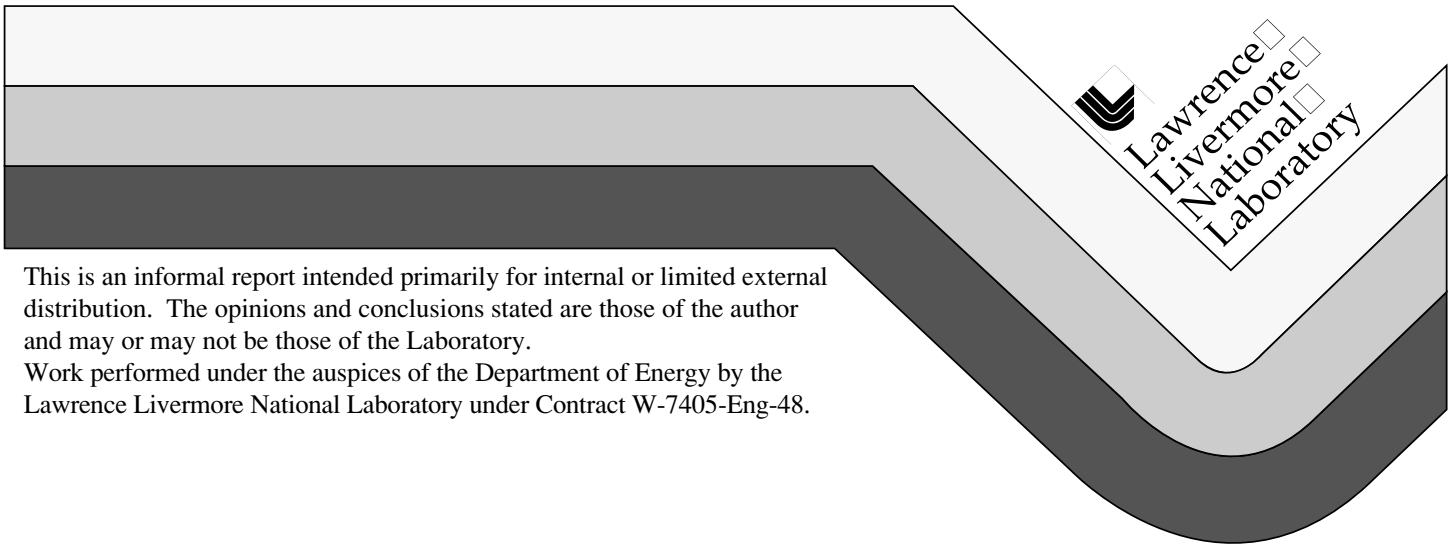

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Abbreviations and Acronyms

3-D	three-dimensional
DOE	U.S. Department of Energy
LBT	Large Block Test

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1. Introduction

The U.S. Department of Energy (DOE) is investigating the suitability of Yucca Mountain as a potential site for the nation's first high-level nuclear waste repository. The site is located about 120 km northwest of Las Vegas, Nevada, at the Nevada Test Site. Favorable aspects of Yucca Mountain as a potential repository site include its arid nature and the sorptive properties of the rock materials. The arid environment results in unsaturated conditions at the potential emplacement horizon, which is the Topopah Spring tuff of the Paintbrush Group.

The Large Block Test (LBT) was designed to be one of a series of tests at different scales and conditions that assist in defining the physical processes that need to be considered in models of a potential repository in Yucca Mountain. The LBT is a critical test because it is of sufficient size to incorporate a fracture system that is representative of the distribution of fracture dimensions and characteristics—with the exception of major structures, such as faults—that would likely be present in a repository. The LBT location was chosen to include large, through-going fractures as well as small, healed fractures that are of limited extent. The LBT location also includes a variety of fracture sizes, connectivities, and characteristics that fall between the bounds of the large and very small fractures. The LBT allows for boundary controls and monitoring that are somewhat similar to those typical of laboratory studies, and it allows for three-dimensional (3-D) characterization and monitoring. The unique combination of size with boundary controls of the LBT allows processes to be evaluated and models to be tested more completely than in tests of any other scale (Wilder et al. 1997, Section 1).

2. Site Selection and Block Preparation

Yucca Mountain lies within the southern part of the Great Basin subprovince of the Basin and Range province in southwestern Nevada, at the southwest corner of the Nevada Test Site. Yucca Mountain is characterized by a series of north-trending, eastward-dipping elongated structural blocks that have been pulled apart and tilted along normal faults. Fran Ridge is located on the east side of Yucca Mountain.

The site at Fran Ridge was selected for the LBT because of its desirable rock type, fracture characteristics, and accessibility. The general location was stripped of vegetation and soil to expose the bedrock. All significant fractures were then mapped in the area. Based on this mapping, it was judged that the general site was adequate for the LBT, specifically that the rock fracturing and matrix block sizes were consistent with what was anticipated to exist at the potential Yucca Mountain repository site (Wilder 1993). Vertical instrumentation holes within the block were drilled and cored before the sawing and excavation of the block A belt saw was used to saw four vertical slots that formed the boundary of the large block. By this excavation process, a block of Topopah Spring tuff measuring 3 x 3 x 4.5 m was

isolated at Fran Ridge. After block excavation was completed and the surfaces were mapped, horizontal boreholes were located (vertical holes had been drilled prior to excavation) for emplacing instrumentation and heaters.

3. Fracture Characterization

Characterization of the block began with mapping and analysis of the distribution of fractures. Fractures were carefully mapped using a 1-ft x 1-ft grid system on all 4 vertical sides of the block. Fracture mapping started on September 19, 1994, and was completed on October 6, 1994. Each fracture was assigned a unique number on each side of the block, and fracture attitudes were measured where possible. Fracture surface roughness was not recorded. More than 2400 individual fractures were mapped. The range and distribution of fracture lengths are recorded in Table 1. The fracture locations were digitized, and fracture segment nodes were assigned x-y-z values. These scattered data points were then input into a 3-D modeling code (Earthvision™). The resulting surface fracture distribution is shown in **Figure 1**, which lists fractures ordered by length and shows that most of the fractures are less than 1 m long.

Table 1. Number of fractures per each length interval and the percentage of fractures occurring in each interval (fractures mapped on all five sides)

Number of Fractures	Length (m)	Percentage	Cumulative Percentage
1044	0.0–.15	43.41	43.41
631	.15–.30	26.24	69.65
251	.30–.46	10.44	80.08
130	.46–.61	5.41	85.49
118	.61–.76	4.91	90.40
59	.76–.91	2.45	92.85
35	.91–1.07	1.46	94.30
32	1.07–1.22	1.33	95.63
24	1.22–1.37	1.00	96.63
13	1.37–1.52	0.54	97.17
8	1.52–1.68	0.33	97.51
5	1.68–1.83	0.21	97.71
8	1.83–1.98	0.33	98.05
6	1.98–2.13	0.25	98.30
6	2.13–2.29	0.25	98.54
3	2.29–2.44	0.12	98.67
3	2.44–2.59	0.12	98.79
2	2.59–2.74	0.08	98.88
5	2.74–2.90	0.21	99.09
2	2.90–3.05	0.08	99.17

Number of Fractures	Length (m)	Percentage	Cumulative Percentage
8	3.05–3.20	0.33	99.50
0	3.20–3.35	0.00	99.50
0	3.35–3.51	0.00	99.50
1	3.51–3.66	0.04	99.54
0	3.66–3.81	0.00	99.54
0	3.81–3.96	0.00	99.54
2	3.96–4.11	0.08	99.63
0	4.11–4.27	0.00	99.63
3	4.27–4.42	0.12	99.75
0	4.42–4.57	0.00	99.75
2	4.57–4.72	0.08	99.83
3	4.72–4.88	0.12	99.96
0	4.88–5.03	0.00	99.96
1	5.03–5.18	0.04	100.00

Numerous boreholes were drilled in the large block for installation of monitoring instrumentation and observation. **Figure 2** shows the location of those boreholes. The angled boreholes (color-coded yellow) are the post-test boreholes.

Fracture data were also collected from the borehole video logs of these holes. Information on the core is not included in this document. Detailed fracture information from the video logs is available in Appendix A. Seventy-one boreholes were videotaped. In that process, a measuring tape was placed in the borehole for location purposes. In the case of the vertical boreholes, the tape was hung along the north side of the hole, which provided an orientation in the borehole. Fractures were logged and described in the boreholes listed in Table 2. The depths at which the fracture enters and exits the borehole were recorded as were the strike, dip, dip direction, aperture, and magnitude of the features. Figure 2 shows the location of the boreholes in the large block. The angled boreholes (color-coded yellow) are the post-test boreholes.

Table 2. Boreholes in which video logs were run

Vertical boreholes drilled from the top of LBT	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10, N1, N2, N3, N4, N5, N6, N7
Horizontal boreholes drilled from the east side of LBT	EH1, EH2, EH3, EH4, EH5, E03
Horizontal boreholes drilled from the west side of LBT	W05, WH1, WH2, WM1, WM2, WM3, WN2, WN3, WN4, WT1, WT2, WT3
Horizontal boreholes drilled from the west side of LBT	N01, N02, NH1, NM1, NM2, NM3, NN1, NN2, NN3, NN4, NN5, NN6, NT1, NT2, NT3, NT4

Post-test bore holes drilled from the north side of LBT	UE25FRPTC#1
	UE25FRPTC#2
	UE25FRPTC#3
	UE25FRPTC#4
	UE25FRPTC#5
	UE25FRPTC#6
	UE25FRPTC#7
	UE25FRPTC#8
	UE25FRPTC#9
Post-test bore holes drilled from the west side of LBT	UE25FRPTC#10
	UE25FRPTC#11
	UE25FRPTC#12
	UE25FRPTC#13
	UE25FRPTC#14
	UE25FRPTC#15
	UE25FRPTC#16
	UE25FRPTC#17
	UE25FRPTC#18
	UE25FRPTC#19
	UE25FRPTC#19a

4. Fracture Analysis

The goal of the fracture analysis is to identify and model the major through-going structures that penetrate the LBT. This involved correlating the surface fracture traces with the location of fractures intersecting the boreholes. Correlation of the borehole fractures with the surface fractures is confirmed by the location and the strike and dip of the fracture as measured in the video log.

Figure 3 is an equal-area diagram of pole to the major fractures that have been defined for the LBT. These fractures are defined by the surface mapping of the LBT and by the video mapping of the boreholes. Table 3 lists the major mappable fractures that have been modeled in the LBT. The individual modeled fractures are grouped into six fracture systems based on similarity in strike and dip. **Figure 4** is a 3-D perspective of these six systems cutting the block.

Table 3. All major fracture planes that have been modeled for the LBT

These fractures are defined by the surface mapping of the LBT and by the video mapping of the boreholes.

Number	Strike	Dip	System Number
LBT21	N32E	82NW	1
LBT11	N49E	43NW	1
LBT22	N52E	58NW	1
LBT2	N30W	78NE	2
LBT15	N37W	62NE	2
LBT14	N26E	01SE	3

Number	Strike	Dip	System Number
LBT1	N36W	11NE	3
LBT30	N53W	09SW	3
LBT32	N68W	13NE	3
LBT31	N70W	09NE	3
LBT33	N78W	23NE	3
LBT38	N03W	89SW	4
LBT12	N04W	89SW	4
LBT16	N05W	89SW	4
LBT13	N10W	87SW	4
LBT37	N11W	88SW	4
LBT42	N16W	80SW	4
LBT36	N17W	87SW	4
LBT41	N18W	81SW	4
LBT20	N18W	87SW	4
LBT35	N18W	87SW	4
LBT6	N22W	78SW	4
LBT40	N25W	80SW	4
LBT5	N34W	77SW	4
LBT34	N70W	80SW	5
LBT8	N78W	79SW	5
LBT39	N78W	87NE	5
LBT3	N89E	90	5
LBT4	N46E	87SE	6

Fracture system #1 is defined by three major fractures called LBT11, LBT21, and LBT22. This system occurs on the south, east, and north sides of the large block and strikes N50E then dips 40–45° to the northwest (**Figure 5**). System #2 consists of two major mapped fractures called LBT2 and LBT15. These fractures strike N30–40W and dip 60-80° to the northeast. The two fractures are mapped on the south and west sides of the large block (**Figure 6**).

Fracture system #3 contains six major mappable fractures. The fractures making up this system are LBT14, LBT30, LBT31, LBT32, and LBT33. LBT1 is by far the most significant fracture in the LBT. It completely cuts through the block and is identified in all vertical boreholes drilled from the top of the large block. As seen in the borehole videos, this feature generally has a wide aperture, common secondary mineralization, and, locally, alteration halos. These fractures are subhorizontal and have strikes that are generally northwest and dip mainly 20° toward the southwest (**Figure 7**). These fractures occur on all four sides of the large block. The dip direction of these fractures is similar to the topographic slope of this part of Fran Ridge.

Fracture system #4 contains the greatest number of fractures. This system is defined by 13 major mappable fractures that penetrate the large block. The fracture attitudes range from N03 to 34W, dipping 77–89° to the southwest. This system is present on all sides of the LBT

and contains a large number of subordinate, associated fractures with similar attitudes (**Figure 8**). Fracture system #5 contains three major mappable fractures that have a general east–west strike and near vertical dips (generally 80–90°) (**Figure 9**). Fracture system #6 is defined by two mappable fractures, LBT4 and LBT23. The fractures strike northeast with near-vertical dips (**Figure 10**).

Figure 11 is an equal-area net of poles to the major fractures that were mapped on top of the large block prior to construction of the LBT. The steeply dipping fractures correlate well with Figure 3, but the subhorizontal fractures are missing. These subhorizontal fractures were not observed in the initial mapping because of the shallow dip of the structures and probable subtle expression at the surface of the ground. This fracture pattern, including the subhorizontal fracture system, compares reasonably well with the fractures and faults that were mapped in the Climax Stock (**Figure 12**), located approximately 50 km northeast of Fran Ridge (Thorpe and Springer 1981, p. 14, Figure 6).

The fracture map of the ground surface above the area of the LBT prior to construction of the block is shown in **Figure 13**. The highlighted fractures have been identified in the large block and then projected to the land surface. Five of the six fracture systems have been identified; the subhorizontal fracture system #3 is not identified on this map. Identification and correlation of the fractures was done by projecting the measured attitudes of the LBT fractures up to the land surface. The gray fractures in Figure 13 were not correlated with specific fracture surfaces in the LBT. These fractures were also not assigned to a specific fracture system because attitude data for them were not available.

Figure 14 through **Figure 18** are two-dimensional presentations of all fractures mapped on the five surfaces of the LBT. The fracture systems are color-coded for increased visual discrimination. The gray fractures in Figues 14 through 18 were not assigned to a specific fracture system.

5. Summary

This data report documents fractures in the Large Block Test at Fran Ridge, Yucca Mountain. More than 2400 individual fractures were mapped on the surface of the block, while more than 1100 fractures were documented in video logs of 71 boreholes. Individual fractures less than .76 m long are the most common on the surface of the block. The major fractures were modeled as 3-D surfaces using the surface and the video fracture data. Six through-going fracture systems were identified within the block. These systems were defined by the major fractures that have similar strike and dip directions. These fracture data will be incorporated into the evaluation of fluid flow during the heating and cooling phases of the Large Block Test.

6. References

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Appendix A
Structures Documented in the Borehole Videos

Structures Documented in the Borehole Videos

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
N1								
		1.83	1.83	–0.14	N–S	W	77	top minor subvertical
		1.83	1.83	–0.47	N–S	W	77	bottom minor subvertical
	LBT1	1.83	1.83	–0.53			18	top large subhorizontal
	LBT1	1.83	1.83	–0.55			18	base large subhorizontal
		1.83	1.83	–0.55	NW–SE	SW	72	top minor subvertical
		1.83	1.83	–0.78	NW–SE	SW	72	bottom minor subvertical
		1.83	1.83	–0.93	E–W	N		top subhorizontal
		1.83	1.83	–0.96	E–W	N		bottom subhorizontal
		1.83	1.83	–1.59	E–W	S	84	tight fracture
		1.83	1.83	–2.28	E–W	S	84	tight fracture
		1.83	1.83	–2.47				horizontal fracture
		1.83	1.83	–2.68	SW–NE	SE	72	tight fracture
		1.83	1.83	–2.91	SW–NE	SE	72	tight fracture
		1.83	1.83	–3.37	SW–NE	SE	34	open subhorizontal
		1.83	1.83	–3.42	SW–NE	SE	34	open subhorizontal
		1.83	1.83	–3.37	SW–NE	SE	72	tight fracture
		1.83	1.83	–3.60	SW–NE	SE	72	tight fracture
		1.83	1.83	–3.78				horizontal fracture
		1.83	1.83	–4.08				horizontal fracture
		1.83	1.83	–4.26				horizontal fracture
		1.83	1.83	–4.36				large horizontal fracture
		1.83	1.83	–4.69				subhorizontal?
		1.83	1.83	–5.10				horizontal partly open
		1.83	1.83	–5.28				horizontal fracture
		1.83	1.83	–5.30	NW–SE	SW	34	top subhorizontal
		1.83	1.83	–5.35	NW–SE	SW		bottom subhorizontal
		1.83	1.83	–5.45	E–W	NE	59	major open fracture
		1.83	1.83	–5.58	E–W	NE	59	major open fracture
N2								
		1.83	1.22	–0.18	E–W	S	63	minor fracture
		1.83	1.22	–0.34	E–W	S	63	minor fracture
	LBT1	1.83	1.22	–0.49				top large subhorizontal
	LBT1	1.83	1.22	–0.52				base large subhorizontal

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.83	1.22	–0.93				horizontal partly open
	LBT17	1.83	1.22	–0.93	N–S	W		may have alteration halo
	LBT17	1.83	1.22	–1.35	N–S	W		may have alteration halo
		1.83	1.22	–1.61	E–W	N	53	tight fracture
		1.83	1.22	–1.71	E–W	N	53	tight fracture
		1.83	1.22	–2.95	E–W	N		top subvertical
		1.83	1.22	–3.00	E–W	N		bottom subvertical
		1.83	1.22	–3.69	E–W	N		top subhorizontal
		1.83	1.22	–3.72	E–W	N		bottom subhorizontal
		1.83	1.22	–3.94	E–W	N		top subhorizontal
		1.83	1.22	–3.97	E–W	N		bottom subhorizontal
		1.83	1.22	–4.30	NW–SE	NE		top subhorizontal
		1.83	1.22	–4.35	NW–SE	NE		bottom subhorizontal
		1.83	1.22	–5.29	NW–SE	SW		top subvertical
		1.83	1.22	–5.44	NW–SE	SW		bottom subvertical
N3								
		1.83	2.44	0.00				open horizontal fracture
	LBT8	1.83	2.44	0.08	NW–SE	SW		top subvertical
	LBT8	1.83	2.44	–0.25	NW–SE	SW		bottom subvertical
	LBT1	1.83	2.44	–0.51			27	top large subhorizontal
	LBT1	1.83	2.44	–0.55			27	base large subhorizontal
		1.83	2.44	–0.99	SW–NE	NW		top subvertical
		1.83	2.44	–1.19	SW–NE	NW		bottom subvertical
		1.83	2.44	–1.02	SW–NE	NW	72	top moderate/major tight subvertical
		1.83	2.44	–1.24	SW–NE	NW	72	bottom moderate/major tight subvertical
		1.83	2.44	–2.11				horizontal fracture
		1.83	2.44	–2.79	E–W	S	34	major subhorizontal
		1.83	2.44	–2.84	E–W	S	34	major subhorizontal
	LBT22	1.83	2.44	–3.06	SW–NE	NW	71	major open subvertical
	LBT22	1.83	2.44	–3.28	SW–NE	NW	71	major open subvertical
	LBT14	1.83	2.44	–3.40			79	horizontal
	LBT14	1.83	2.44	–3.81			79	horizontal
		1.83	2.44	–4.17				horizontal fracture
		1.83	2.44	–4.27				horizontal fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.83	2.44	–4.32	SW–NE	SE	82	minor fracture
		1.83	2.44	–4.34				horizontal fracture
		1.83	2.44	–4.52				horizontal fracture
		1.83	2.44	–4.75				horizontal fracture
		1.83	2.44	–4.88	SW–NE	SE		minor
		1.83	2.44	–5.03	E–W			horizontal fracture
		1.83	2.44	–5.31				horizontal fracture
N4								
	LBT1	1.52	3.05	–0.43			18	top large subhorizontal
	LBT1	1.52	3.05	–0.46			18	base large subhorizontal
		1.52	3.05	–0.56			84	subhorizontal
		1.52	3.05	–1.23			84	subhorizontal
	LBT12	1.52	3.05	–1.27	SW–NE	NW	78	major subvertical
	LBT12	1.52	3.05	–1.62	SW–NE	NW	78	major subvertical
		1.52	3.05	–1.98				horizontal fracture
	LBT13	1.52	3.05	–1.98	E–W	S?		top highly fractured zone—open major
	LBT13	1.52	3.05	–3.07	E–W	S?		base highly fractured zone—open major
		1.52	3.05	–3.43	SW–NE	NW	59	top subvertical
		1.52	3.05	–3.55	SW–NE	NW	59	base subvertical
		1.52	3.05	–3.45				horizontal fracture
		1.52	3.05	–3.48				horizontal fracture
		1.52	3.05	–3.76				horizontal fracture
		1.52	3.05	–3.73				horizontal fracture
		1.52	3.05	–3.99				horizontal fracture
	LBT22	1.52	3.05	–4.09	N–S	W	53	top major subvertical-open
	LBT22	1.52	3.05	–4.19	N–S	W	53	base major subvertical-open
		1.52	3.05	–4.32	NW–SE		69	top major open fracture?
		1.52	3.05	–4.52	NW–SE		69	base major open fracture?
		1.52	3.05	–4.60				horizontal fracture
		1.52	3.05	–4.98				horizontal fracture
		1.52	3.05	–5.03	E–W	N	53	tight fracture
		1.52	3.05	–5.13	E–W	N	53	tight fracture
		1.52	3.05	–4.80	NW–SE	SW	83	tight fracture
		1.52	3.05	–5.38	NW–SE	SW	83	tight fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.52	3.05	–5.41	SW–NE	SE	53	major open fracture
		1.52	3.05	–5.51	SW–NE	SE	53	major open fracture
N5								
	LBT1	0.00	1.52	–0.17				top large subhorizontal
	LBT1	0.00	1.52	–0.51				base large subhorizontal
		0.00	1.52	–0.29	N–S	E	90	base vertical fracture
	LBT2	0.00	1.52	–0.24	N–S	E	77	top major? subvertical
	LBT2	0.00	1.52	–0.57	N–S	E	77	base major? subvertical
		0.00	1.52	–0.60	SW–NE	NW		fracture
		0.00	1.52	–0.93				base subvertical
		0.00	1.52	–1.03				horizontal fracture
		0.00	1.52	–1.51				horizontal fracture
		0.00	1.52	–1.89				horizontal fracture
		0.00	1.52	–2.60	NW–SE	NE		top sharp, open minor subvertical
		0.00	1.52	–2.76	NW–SE	NE		bottom sharp, open minor subvertical
		0.00	1.52	–2.86				horizontal fracture
		0.00	1.52	–3.16				horizontal fracture
		0.00	1.52	–3.47				horizontal fracture
	LBT20	0.00	1.52	–3.47	E–W	S	78	top major subvertical open fracture
	LBT20	0.00	1.52	–3.82	E–W	S	78	base major subvertical open fracture
		0.00	1.52	–3.70				horizontal fracture
		0.00	1.52	–3.87				horizontal fracture
		0.00	1.52	–4.69	N–S	W	81	top open fracture
		0.00	1.52	–4.74				horizontal fracture
		0.00	1.52	–4.89				horizontal fracture
		0.00	1.52	–5.17	N–S	W	81	base open fracture
N6								
		1.52	0.00	0.05				horizontal fracture
		1.52	0.00	–0.15				horizontal fracture
	LBT1	1.52	0.00	–0.38			18	top large subhorizontal
	LBT1	1.52	0.00	–0.40			18	base large subhorizontal

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.52	0.00	–0.66	N–S	W	89	top subvertical, cannot see base
		1.52	0.00	–0.73			89	horizontal fracture
		1.52	0.00	–0.81				horizontal fracture
		1.52	0.00	–1.22				horizontal fracture
		1.52	0.00	–1.57				horizontal fracture
		1.52	0.00	–1.67				horizontal fracture
		1.52	0.00	0.00	N–S	W		base subvertical
	LBT2	1.52	0.00	–1.90	N45W	NE	76	top significant subvertical
	LBT2	1.52	0.00	–2.21	N45W	NE	76	base significant subvertical
		1.52	0.00	–2.10				horizontal fracture
		1.52	0.00	–2.66				horizontal fracture
	LBT17	1.52	0.00	–2.92	N30W	SW	73	top major subvertical (alteration halo?)
	LBT17	1.52	0.00	–3.17	N30W	SW	73	base major subvertical (alteration halo?)
		1.52	0.00	–3.65				horizontal fracture
		1.52	0.00	–4.49	N–S	W	81	top subvertical
		1.52	0.00	–4.95	N–S	W	81	base subvertical
		1.52	0.00	–4.95	N–S	W	53	top subvertical
		1.52	0.00	–5.05	N–S	W	53	base subvertical
		1.52	0.00	–5.10				horizontal fracture
	LBT11(?)	1.52	0.00	–5.25	N30W	NE	82	major sharp open fracture
N7								
		3.05	1.52	–0.24				horizontal fracture
	LBT1	3.05	1.52	–0.63				top large subhorizontal
	LBT1	3.05	1.52	–0.65				base large subhorizontal
		3.05	1.52	–1.06				horizontal fracture
	LBT21	3.05	1.52	–1.26	N–S	W	76	top minor subvertical
	LBT21	3.05	1.52	–1.57	N–S	W	76	base minor subvertical
		3.05	1.52	–1.49				horizontal fracture
		3.05	1.52	–1.92				horizontal fracture
		3.05	1.52	–3.27				horizontal fracture
		3.05	1.52	–3.88				horizontal fracture
		3.05	1.52	–4.41	E–W	N		top subvertical
		3.05	1.52	–4.46	E–W	N		base subvertical

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		3.05	1.52	–4.72			90	several vertical cooling joints?
		3.05	1.52	–5.02				horizontal fracture
		3.05	1.52	–5.15				horizontal fracture
E1								
		2.44	1.22	–0.09				horizontal fracture
	LBT1	2.44	1.22	–0.57			34	top large subhorizontal
	LBT1	2.44	1.22	–0.59			34	base large subhorizontal
		2.44	1.22	–0.92	~N45W	NE?		goes out same side of hole
		2.44	1.22	–1.03				horizontal fracture
		2.44	1.22	–1.10	~N45W	NE?		goes out same side of hole
		2.44	1.22	–1.23				horizontal fracture
		2.44	1.22	–1.38				horizontal fracture
		2.44	1.22	–1.43	~N45W			fracture
		2.44	1.22	–1.79				horizontal fracture
		2.44	1.22	–2.78				base of open fracture
		2.44	1.22	–3.08	NW	SW		significant fracture
		2.44	1.22	–3.29	NW	SW		significant fracture
		2.44	1.22	–3.34	N–S	E		top open dipping subhorizontal fracture
		2.44	1.22	–3.36	N–S	E		bottom open dipping subhorizontal fracture
		2.44	1.22	–3.46				top rubble continuous
		2.44	1.22	–3.72				base rubble zone
		2.44	1.22	–3.57				gaping fracture (cooling joint?)
		2.44	1.22	–3.72				leaves same side of hole
		2.44	1.22	–4.05	E–W	S	79	top subvertical
		2.44	1.22	–4.25	E–W	S	79	base subvertical
		2.44	1.22	–4.28	E–W	S	78	top subvertical
		2.44	1.22	–4.38				horizontal fracture
		2.44	1.22	–4.45	E–W	S	78	base subvertical
		2.44	1.22	–4.53				horizontal fracture
		2.44	1.22	–4.61				top subhorizontal
		2.44	1.22	–4.66				bottom subhorizontal
		2.44	1.22	–4.81	E–W	S	69	top subvertical
		2.44	1.22	–4.91	E–W	S	69	base subvertical

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.44	1.22	–5.17	N–S	W	84	top major open subvertical
		2.44	1.22	–5.22				horizontal fracture
		2.44	1.22	–5.52	N–S	W	84	bottom major open subvertical
E2								
		2.44	1.83	–0.16				horizontal fracture
	LBT1	2.44	1.83	–0.59			34	top large subhorizontal
	LBT1	2.44	1.83	–0.62			34	base large subhorizontal
		2.44	1.83	–1.02				horizontal fracture
		2.44	1.83	–1.40				horizontal fracture
		2.44	1.83	–1.68	E–W	S		minor fracture
		2.44	1.83	–1.86	E–W	S		minor fracture
		2.44	1.83	–1.86				horizontal fracture
		2.44	1.83	–1.99				horizontal fracture
		2.44	1.83	–2.85				horizontal fracture
		2.44	1.83	–3.16	N–S			major open cooling? joint
		2.44	1.83	–3.46	N–S			major open cooling? joint
		2.44	1.83	–3.40	E–W	S		top minor subhorizontal
		2.44	1.83	–3.44	E–W	S		bottom minor subhorizontal
		2.44	1.83	–3.56	E–W	E		top minor/moderate subhorizontal
		2.44	1.83	–3.59	E–W	E		bottom minor/moderate subhorizontal
		2.44	1.83	–4.02				horizontal fracture
		2.44	1.83	–4.07				horizontal fracture
		2.44	1.83	–4.15	N–S	W		top minor subhorizontal
		2.44	1.83	–4.20	N–S	W		bottom minor subhorizontal
		2.44	1.83	–4.30				horizontal fracture
		2.44	1.83	–4.43	NW–SE	NE		top open moderate sharp subhorizontal
		2.44	1.83	–4.45	NW–SE	NE		bottom moderate open sharp subhorizontal
		2.44	1.83	–4.76				horizontal fracture
		2.44	1.83	–4.83	N–S	E	53	minor fracture
		2.44	1.83	–4.88	N–S	E	53	minor fracture
		2.44	1.83	–4.91	N–S			major open curving cooling? joint

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.44	1.83	–5.09	N–S			major open curving cooling? joint
		2.44	1.83	–5.14				horizontal fracture
		2.44	1.83	–5.19				open joint
		2.44	1.83	–5.37				open joint
		2.44	1.83	–5.26	N–S	W	90	major open vertical joint
E3								
		1.83	0.61	0.03	N–S	W		top subvertical (can't see base)
	LBT1	1.83	0.61	–0.37			34	top large subhorizontal
	LBT1	1.83	0.61	–0.39			34	base large subhorizontal
		1.83	0.61	–0.79				horizontal fracture
	LBT17	1.83	0.61	–0.89	N–S	W	79	major subvertical (halo?)
	LBT17	1.83	0.61	–1.09	N–S	W	79	major subvertical (halo?)
		1.83	0.61	–1.09	NE–SW		69	minor fracture
		1.83	0.61	–1.19	NE–SW		69	minor fracture
		1.83	0.61	–1.24				horizontal fracture
		1.83	0.61	–1.80				horizontal fracture
		1.83	0.61	–2.77				horizontal fracture
		1.83	0.61	–3.07				horizontal fracture
		1.83	0.61	–3.68				horizontal fracture
		1.83	0.61	–4.34				horizontal fracture
		1.83	0.61	0.00	N–S	W		minor fracture
		1.83	0.61	–4.42	N–S	W		minor fracture
		1.83	0.61	–4.90	NE–SW	NW	76	moderate fracture
		1.83	0.61	–5.05	NE–SW	NW	76	moderate fracture
		1.83	0.61	–5.28				horizontal fracture
E4								
		1.52	1.37	–0.18				horizontal fracture
	LBT1	1.52	1.37	–0.38			34	top large subhorizontal
	LBT1	1.52	1.37	–0.41			34	base large subhorizontal
		1.52	1.37	–0.48				horizontal fracture
		1.52	1.37	–0.89				horizontal fracture
		1.52	1.37	–1.25				horizontal fracture
		1.52	1.37	–1.42	N–S	W	69	minor fracture
		1.52	1.37	–1.53	N–S	W	69	minor fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.52	1.37	–1.58	N–S	W		top open major/moderate subhorizontal
		1.52	1.37	–1.65	N–S	W		base open major/moderate subhorizontal
		1.52	1.37	–2.29	E–W	S	69	minor fracture
		1.52	1.37	–2.39	E–W	S	69	minor fracture
		1.52	1.37	–2.42				horizontal fracture
		1.52	1.37	–3.25				horizontal fracture
		1.52	1.37	–3.46				horizontal fracture
		1.52	1.37	–3.58				horizontal fracture
		1.52	1.37	–3.63				horizontal fracture
		1.52	1.37	–3.86	E–W	S	63	minor fracture
		1.52	1.37	–3.94	E–W	S	63	minor fracture
		1.52	1.37	–3.89	N–S	W	63	minor fracture
		1.52	1.37	–3.96	N–S	W	63	minor fracture
		1.52	1.37	–4.12				horizontal fracture
		1.52	1.37	–5.13				horizontal fracture
E5								
		1.22	0.61	0.13				horizontal fracture
	LBT1	1.22	0.61	–0.30				top large subhorizontal
	LBT1	1.22	0.61	–0.34				base large subhorizontal
	LBT16	1.22	0.61	–0.13	N–S	W	34	moderate fracture
	LBT16	1.22	0.61	–0.15	N–S	W	34	moderate fracture
		1.22	0.61	–0.20	E–W	S	81	minor subvertical
		1.22	0.61	–0.43	E–W	S	81	minor subvertical
		1.22	0.61	–0.74				horizontal fracture
		1.22	0.61	–1.14				horizontal fracture
		1.22	0.61	–1.55				horizontal fracture
		1.22	0.61	–1.57				horizontal fracture
	LBT2	1.22	0.61	–2.18	N–S	E		top open subvertical
	LBT2	1.22	0.61	–2.23	N–S	E		base open subvertical
		1.22	0.61	–3.43	E–W	S	89	minor fracture
		1.22	0.61	0.00	E–W	S	89	minor fracture
		1.22	0.61	–3.61				horizontal fracture
		1.22	0.61	–4.09				open horizontal fracture
		1.22	0.61	–4.72				horizontal fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.22	0.61	–4.77				horizontal fracture
		1.22	0.61	–4.88	E–W	S		minor fracture
		1.22	0.61	–4.95	NE–SW	SE	79	moderate fracture
		1.22	0.61	–5.16	NE–SW	SE	79	moderate fracture
E6								
								horizontal fracture
	LBT1	1.22	1.22	–0.32			34	top large subhorizontal
	LBT1	1.22	1.22	–0.34			34	base large subhorizontal
	LBT16	1.22	1.22	–0.22	N–S	W	63	moderate open subvertical
	LBT16	1.22	1.22	–0.29	N–S	W	63	moderate open subvertical
		1.22	1.22	–1.16				horizontal fracture
		1.22	1.22	–1.59				horizontal fracture
		1.22	1.22	–2.63			34	minor subvertical
		1.22	1.22	–2.65			34	minor subvertical
	LBT2	1.22	1.22	–3.52	N–S	E		highly fractured zone
		1.22	1.22	–4.05	N–S	E		probably more than one fracture
E7								
		1.22	1.83	0.00				horizontal fracture
		1.22	1.83	–0.38				horizontal fracture
	LBT1	1.22	1.83	–0.46			34	top large subhorizontal
	LBT1	1.22	1.83	–0.48			34	base large subhorizontal
	LBT16	1.22	1.83	–0.25	N–S	W	73	moderate open fracture
	LBT16	1.22	1.83	–0.38	N–S	W	73	moderate open fracture
		1.22	1.83	–0.86	N–S	W	69	minor fracture
		1.22	1.83	–0.89			69	horizontal fracture
		1.22	1.83	–0.96	N–S	W		minor fracture
		1.22	1.83	–1.09				wandering partly open fracture
		1.22	1.83	–1.55				wandering partly open fracture
		1.22	1.83	–2.16	E–W	S		top minor fracture
		1.22	1.83	–2.39	E–W	S		base minor fracture
		1.22	1.83	–2.62				horizontal fracture
		1.22	1.83	–3.17				horizontal fracture
		1.22	1.83	–3.61				horizontal fracture
		1.22	1.83	–3.71				horizontal fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.22	1.83	–3.83				horizontal fracture
E8								
		1.22	2.44	–0.01				horizontal fracture
	LBT1	1.22	2.44	–0.50				top large subhorizontal
	LBT1	1.22	2.44	–0.55				base large subhorizontal
	LBT16	1.22	2.44	–0.06	N–S	W		moderate/major open subvertical
	LBT16	1.22	2.44	–0.11	N–S	W		moderate/major open subvertical
		1.22	2.44	–0.27			34	open subhorizontal fracture
		1.22	2.44	–0.29			34	open subhorizontal fracture
		1.22	2.44	–1.36	E–W	S		minor subvertical
		1.22	2.44	–1.44	E–W	S		minor subvertical
		1.22	2.44	–1.87				horizontal fracture
	LBT12	1.22	2.44	–2.40	E–W	S		top major open subvertical
	LBT12	1.22	2.44	–2.48	E–W	S		bottom major open subvertical
		1.22	2.44	–2.73	E–W	S		bottom major open subvertical
		1.22	2.44	–2.65	N–S	W	83	top major open subvertical
		1.22	2.44	–2.96	N–S	W	83	bottom major open subvertical
		1.22	2.44	–2.65	E–W	N	77	top major open subvertical
		1.22	2.44	–2.82	E–W	N	77	bottom major open subvertical
		1.22	2.44	–3.04	NE–SW	SE		major open fracture
		1.22	2.44	–3.09	NE–SW	SE		major open fracture
	LBT22	1.22	2.44	–3.11	NE–SW	NW		major open fracture
	LBT22	1.22	2.44	–3.19	NE–SW	NW		major open fracture
		1.22	2.44	–3.44	E–W	S	79	minor fracture
		1.22	2.44	–3.65	E–W	S	79	minor fracture
		1.22	2.44	–3.54				horizontal fracture
		1.22	2.44	–3.65				horizontal fracture
		1.22	2.44	–3.67	N–S	W	84	top major open subvertical
		1.22	2.44	–4.05	N–S	W	84	bottom major open subvertical
		1.22	2.44	–4.26	NE–SW	SE	73	minor fracture
		1.22	2.44	–4.38	NE–SW	SE	73	minor fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.22	2.44	–4.51			90	vertical open joint
		1.22	2.44	–4.71			90	vertical open joint
		1.22	2.44	–4.76				subhorizontal fracture
		1.22	2.44	–4.94				horizontal fracture
		1.22	2.44	–5.07	N–S	W		tight, minor fracture
		1.22	2.44	–5.17	N–S	W		tight, minor fracture
E9								
		0.61	1.22	0.04				horizontal fracture
	LBT1	0.61	1.22	–0.29			34	top large subhorizontal
	LBT1	0.61	1.22	–0.32			34	base large subhorizontal
		0.61	1.22	–0.32	N–S	W	63	tight, minor fracture
		0.61	1.22	–0.40	N–S	W	63	tight, minor fracture
		0.61	1.22	–0.73				horizontal fracture
		0.61	1.22	–0.95				horizontal fracture
		0.61	1.22	–0.95	SE–NW	SW	63	tight, minor fracture
		0.61	1.22	–1.03	SE–NW	SW	63	tight, minor fracture
		0.61	1.22	–1.13				horizontal fracture
	LBT16	0.61	1.22	–1.13	N–S	W		open fracture
		0.61	1.22	–1.26	E–W	S	63	moderate fracture
		0.61	1.22	–1.34	E–W	S	63	moderate fracture
		0.61	1.22	–1.44	N–S	W	73	moderate fracture
		0.61	1.22	–1.56	N–S	W	73	moderate fracture
	LBT2	0.61	1.22	–1.67	SE–NW	NE	76	major open fracture!
	LBT2	0.61	1.22	–1.82	SE–NW	NE	76	major open fracture!
		0.61	1.22	–3.82				horizontal fracture
		0.61	1.22	–4.26				horizontal fracture
		0.61	1.22	–5.02				top subhorizontal
		0.61	1.22	–5.20				base subhorizontal
E10								
		0.61	1.83	0.15				horizontal fracture
	LBT1	0.61	1.83	–0.36			34	top large subhorizontal
	LBT1	0.61	1.83	–0.38			34	base large subhorizontal
		0.61	1.83	0.15	N–S	W	81	major open fracture
		0.61	1.83	–0.10	N–S	W	81	major open fracture
		0.61	1.83	–1.25	N–S	W	63	major open fracture
		0.61	1.83	–1.32	N–S	W	63	major open fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
	LBT16	0.61	1.83	–1.27	N–S	W	81	major open fracture
	LBT16	0.61	1.83	–1.50	N–S	W	81	major open fracture
	LBT12	0.61	1.83	–2.77	E–W	S	78	major open fracture
	LBT12	0.61	1.83	–2.95	E–W	S	78	major open fracture
	LBT2	0.61	1.83	–3.07	SE–NW	NE	79	major open fracture
	LBT2	0.61	1.83	–3.28	SE–NW	NE	79	major open fracture
	LBT14	0.61	1.83	–3.23				open horizontal fracture
		0.61	1.83	–3.71				horizontal fracture
		0.61	1.83	–3.84				horizontal fracture
		0.61	1.83	–5.11	SW–NE	SE		minor fracture
EH1								
	LBT21	2.84	0.30	–2.74			90	moderate vertical open fracture
		2.64	0.30	–2.74			90	minor vertical closed fracture
		2.51	0.30	–2.74	N60E	SE	80	angled partly open fracture
		2.44	0.30	–2.74	N60E	SE	80	angled partly open fracture
		2.54	0.30	–2.74				closed, healed subhorizontal fracture
		2.11	0.30	–2.74				closed, healed subhorizontal fracture
		1.98	0.30	–2.74			90	minor vertical fracture
		1.60	0.30	–2.74			90	moderate vertical open fracture
	LBT2	1.57	0.30	–2.74	N50W	NE	80	major open angled fracture, subvertical
	LBT2	1.52	0.30	–2.74	N50W	NE	80	major open angled fracture, subvertical
	LBT17(?)	1.50	0.30	–2.74			90	minor vertical fracture
		1.45	0.30	–2.74	N30E		90	major open fracture, vertical
		1.42	0.30	–2.74	N30E		90	major open fracture, vertical
		0.74	0.30	–2.74	NE–SW			minor subvertical closed fracture
EH2								
	LBT21	2.79	0.91	–2.74			90	significant vertical fracture
		2.74	0.91	–2.74			90	significant vertical fracture, open

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.89	0.91	–2.74				minor subvertical closed fracture
		1.57	0.91	–2.74	NE–SW			subvertical open fracture
	LBT17(?)	1.57	0.91	–2.74	N30W	SW	70	moderate open fracture
	LBT17(?)	1.55	0.91	–2.74	N30W	SW	70	moderate open fracture
		1.14	0.91	–2.74	NW–SE	SW		moderate partly open subvertical fracture
		0.74	0.91	–2.74				minor random irregular closed fractures
		0.30	0.91	–2.74				minor random irregular closed fractures
EH3								
		2.79	1.52	–2.74			90	minor vertical closed fracture
		2.67	1.52	–2.74			90	minor vertical closed fracture, partly open
		2.44	1.52	–2.74			90	minor vertical closed fracture
		1.85	1.52	–2.74			90	minor vertical closed fracture
		1.40	1.52	–2.74			90	minor vertical closed fracture
		1.37	1.52	–2.74	N10E		90	major open vertical fracture
		1.19	1.52	–2.74			90	minor partly open vertical fracture
		0.97	1.52	–2.74			90	minor partly open vertical fracture
	LBT2(?)	0.66	1.52	–2.74	N40W	NE	70	angled vertical tight fracture
	LBT2(?)	0.61	1.52	–2.74	N40W	NE	70	angled vertical tight fracture
EH4								
		2.79	2.13	–2.74			90	minor vertical partly open fracture
		2.77	2.13	–2.74			90	minor vertical partly open fracture
	LBT6	2.64	2.13	–2.74	N10W		90	major(?) open vertical fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.57	2.13	–2.74	NW–SE		90	minor–moderate angled partly open vertical fracture
		2.54	2.13	–2.74	NW–SE		90	minor–moderate angled partly open vertical fracture
		2.57	2.13	–2.74	NE–SW			minor subvertical fracture
		2.51	2.13	–2.74	NE–SW			minor subvertical fracture
		2.06	2.13	–2.74			90	major open vertical fracture
	LBT12(?)	2.03	2.13	–2.74			90	major open vertical fracture, less significant then above
		1.78	2.13	–2.74	N20E	NW	90	major vertical open fracture
		1.65	2.13	–2.74			90	minor vertical fracture
		1.50	2.13	–2.74			90	minor fine fracture, vertical barely open
		1.45	2.13	–2.74			90	minor fine fracture, vertical barely open
		1.40	2.13	–2.74			90	minor fine fracture, vertical barely open
		1.32	2.13	–2.74			90	open vertical fracture, more significant then above
	LBT17(?)	1.09	2.13	–2.74	N60E	SE	50	major angled open fracture
	LBT17(?)	1.04	2.13	–2.74	N60E	SE	50	major angled open fracture
		0.99	2.13	–2.74	N60E	SE	45	major angled open fracture
		0.91	2.13	–2.74	N60E	SE	45	major angled open fracture
	LBT23	0.81	2.13	–2.74	N20E	NW	45	major angled open fracture
	LBT23	0.76	2.13	–2.74	N20E	NW	45	major angled open fracture
EH5								
		2.84	2.74	–2.74			90	major open vertical fracture
		2.82	2.74	–2.74	N–S	E	20	minor tight closed subhorizontal healed fracture
		2.69	2.74	–2.74	N–S	E	20	minor tight closed subhorizontal healed fracture
		2.69	2.74	–2.74			90	minor vertical partly open fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.64	2.74	–2.74	N30E	SE	80	moderate angled open fracture
		2.62	2.74	–2.74	N30E	SE	80	moderate angled open fracture
		2.29	2.74	–2.74	N–S	W		minor tight subvertical fracture
		2.26	2.74	–2.74	N–S	W		minor tight subvertical fracture
	LBT6	2.13	2.74	–2.74	N20W		90	major open vertical fracture zone
		1.88	2.74	–2.74	N–S	E	20	moderate subhorizontal fracture, with assoc. other minors
		1.73	2.74	–2.74	N–S	E	20	moderate subhorizontal fracture, with assoc. other minors
	LBT13(?)	1.60	2.74	–2.74			90	minor vertical fracture
	LBT23	1.49	2.74	–2.74	N30E		80	moderate open vertical fracture
	LBT12(?)	1.22	2.74	–2.74			90	major open vertical sharp fracture
		0.99	2.74	–2.74	N–S	E	20	moderate subhorizontal closed fracture
		0.89	2.74	–2.74	N–S	E	20	moderate subhorizontal closed fracture
		0.91	2.74	–2.74	N80W		80	angled moderate(?) partly open fractures
		0.71	2.74	–2.74	N80W		80	angled moderate(?) partly open fractures
		0.61	2.74	–2.74				minor subvertical closed fracture, healed
		0.53	2.74	–2.74				minor subvertical closed fracture
E03								
	LBT7	2.93	2.74	–3.96			90	vertical open fracture
		2.54	2.74	–3.96	N–S	E	30	moderate closed fracture
		2.49	2.74	–3.96	N–S	E	30	moderate closed fracture
		2.46	2.74	–3.96	N60W	NW		angled moderate fracture, open, subvertical
		2.44	2.74	–3.96	N60W	NW		angled moderate fracture, open, subvertical

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.36	2.74	–3.96	E–W		90	moderate partly open fracture
		2.31	2.74	–3.96	E–W		90	moderate partly open fracture
		2.24	2.74	–3.96			90	minor vertical fracture
		2.04	2.74	–3.96	N45E		90	angled minor closed fracture
		1.98	2.74	–3.96	N45E		90	angled minor closed fracture
	LBT6	1.78	2.74	–3.96	N70W	NE	80	major angled fracture
	LBT6	1.65	2.74	–3.96	N70W	NE	80	major angled fracture
		1.47	2.74	–3.96	N30E		90	major angled locally open fracture
		1.42	2.74	–3.96	N30E		90	major angled locally open fracture
		1.42	2.74	–3.96				2 open moderate subvertical fractures
		1.40	2.74	–3.96				2 open moderate subvertical fractures
		1.30	2.74	–3.96			90	major large open vertical fractures
		0.99	2.74	–3.96				minor subvertical tight fractures
		0.97	2.74	–3.96				minor subvertical tight fractures
		0.66	2.74	–3.96	~N–S	E	10	major open subhorizontal fracture, complex system
		0.38	2.74	–3.96	~N–S	E	10	major open subhorizontal fracture, complex system
NH1								
	LBT22	2.13	2.72	–2.44	NE–SW	NW	80	major open angled fracture
	LBT22	2.13	2.06	–2.44	NE–SW	NW	80	major open angled fracture
		2.13	1.80	–2.44	E–W		90	minor tight vertical fracture
		2.13	1.09	–2.44	E–W		90	moderate-major vertical partly open fracture
		2.13	0.66	–2.44	N30W	SW	60	minor-moderate angled tight fracture
		2.13	0.28	–2.44	N30W	SW	60	minor-moderate angled tight fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
NM1								
		2.74	2.64	–3.81				series of tight minor vertical to subvertical fractures
		2.74	2.49	–3.81				series of tight minor vertical to subvertical fractures
	LBT8	2.74	1.80	–3.81	N80E	S	70	major subvertical fracture
	LBT8	2.74	1.73	–3.81	N80E	S	70	major subvertical fracture
		2.74	1.73	–3.81				series of minor subvertical fractures
		2.74	1.63	–3.81				series of minor subvertical fractures
	LBT3	2.74	1.50	–3.81			90	minor-moderate partly open vertical fracture
		2.74	1.09	–3.81	N45W	SW	80	angled minor subvertical fracture
		2.74	0.99	–3.81	N45W	SW	80	angled minor subvertical fracture
NM2								
		0.91	3.02	–2.44	E–W			minor-moderate tight fracture
		0.91	2.72	–2.44	E–W			minor-moderate tight fracture
		0.91	2.29	–2.44	E–W		90	major open vertical fracture
		0.91	1.93	–2.44	E–W	N?		tough to see, but looks like a minor fracture
		0.91	1.83	–2.44				minor tight subvertical fracture
		0.91	1.73	–2.44				moderate open subvertical fracture
	LBT2	0.91	1.12	–2.44	N45W	SW	70	major angled open fracture
	LBT2	0.91	0.99	–2.44	N45W	SW	70	major angled open fracture
	LBT3	0.91	0.97	–2.44	E–W		90	moderate-major vertical open fracture
		0.91	0.61	–2.44	E–W			minor tight fracture
		0.91	0.28	–2.44	E–W			minor tight fracture
NM3								
	LBT24	0.30	2.39	–0.91	NE–SW	NW		moderate angled tight fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
	LBT24	0.30	2.21	–0.91	NE–SW	NW		moderate angled tight fracture
	LBT2	0.30	1.24	–0.91	NW–SE	NE		major open angled fracture
		0.30	1.12	–0.91	NW–SE	NE		major open angled fracture
	LBT3	0.30	1.07	–0.91			90	moderate open(?) vertical fracture
		0.30	0.48	–0.91	E–W		90	moderate-major vertical open wet fracture
NN1								
		2.13	2.87	–0.91	NW–SE	NE		moderate-major angled partly open fracture
		2.13	2.79	–0.91	NW–SE	NE		moderate-major angled partly open fracture
	LBT8	2.13	2.24	–0.91	NW–SE	S?	90	minor tight nearly vertical fracture
		2.13	2.18	–0.91			90	moderate vertical open wet fracture
		2.13	2.11	–0.91			90	minor vertical open wet fracture
		2.13	1.83	–0.91			90	minor nearly vertical closed fracture
		2.13	1.30	–0.91	NW–SE	SW		moderate-major angled fracture partly open
		2.13	1.17	–0.91	NW–SE	SW		moderate-major angled fracture partly open
		2.13	1.02	–0.91			90	moderate open wet vertical fracture
		2.13	0.56	–0.91			90	vertical partly open fracture
		2.13	0.33	–0.91			90	vertical open moderate-major fracture
NN2								
	LBT6	2.13	2.91	–1.98				major?, healed? vertical fracture
		2.13	2.72	–1.98				minor tight vertical fracture
		2.13	2.64	–1.98	N45E			angled minor tight subvertical fracture
		2.13	2.62	–1.98	N45E			angled minor tight subvertical fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.13	2.24	–1.98	N45E			moderate tight angled subvertical fracture
		2.13	2.18	–1.98	N45E			moderate tight angled subvertical fracture
		2.13	1.93	–1.98	E–W		90	minor/moderate tight fracture
		2.13	1.35	–1.98	E–W		90	minor/moderate tight fracture
		2.13	1.23	–1.98	N30W	SW	70	minor-moderate partly open angled fracture
		2.13	1.04	–1.98	N30W	SW	70	minor-moderate partly open angled fracture
		2.13	1.17	–1.98	~N–S	W		major-moderate fracture (leaves same side of hole)
		2.13	1.07	–1.98	~N–S	W		major-moderate fracture (leaves same side of hole)
	LBT3	2.13	1.09	–1.98			90	major vertical open fracture
		2.13	0.71	–1.98	N45E	SE	70	minor closed angled fracture
		2.13	0.67	–1.98	N45E	SE	70	minor closed angled fracture
NN3								
		2.13	2.91	–3.81	N45E		90	major open vertical fracture
		2.13	2.39	–3.81	NE–SW		90	major angled vertical fracture
		2.13	2.60	–3.81	NE–SW		90	major angled vertical fracture
		?	?	?			90	major open vertical fracture
		2.13	1.75	–3.81	NW–SE			highly fractured zone
		2.13	1.60	–3.81	NW–SE			highly fractured zone
		2.13	1.60	–3.81	E–W			major(?) partly open subhorizontal fracture
		2.13	1.30	–3.81	E–W			major(?) partly open subhorizontal fracture
	LBT3	2.13	1.04	–3.81	E–W			major(?) subvertical open fracture
		2.13	1.04	–3.81	E–W	S	15	major(?) continuous horizontal(?) fracture
		2.13	0.74	–3.81	E–W	S	15	major(?) continuous horizontal(?) fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.13	0.84	–3.81	E–W	N	15	major open subhorizontal fracture
		2.13	0.51	–3.81	E–W	N	15	major open subhorizontal fracture
		2.13	0.51	–3.81				wandering minor subhorizontal fracture
		2.13	0.28	–3.81				wandering minor subhorizontal fracture
NN4								
		0.91	2.92	–0.91	NW–SE	NE		moderate-major angled fracture, open
		0.91	2.84	–0.91	NE–SW	NW		moderate-major open angled fracture
		0.91	2.77	–0.91	NE–SW	NW		moderate-major open angled fracture
		0.91	2.77	–0.91	E–W		90	moderate open wet vertical fracture
		0.91	2.31	–0.91	NW–SE	SW		minor angled closed fracture
		0.91	1.57	–0.91	NE–SW	SE		minor tight subvertical fracture
		0.91	1.50	–0.91	~N–S	W		major open angled fracture, trending along side of hole
		0.91	1.09	–0.91	~N–S	W		major open angled fracture, trending along side of hole
	LBT3	0.91	1.07	–0.91			90	major open vertical wet fracture
		0.91	0.89	–0.91	~N–S	W		moderate-major fracture barely grazing side of hole
		0.91	0.79	–0.91	~N–S	W		moderate-major fracture barely grazing side of hole
		0.91	0.71	–0.91	NW–SE	SSW		major angled open fracture
		0.91	0.53	–0.91	NW–SE	SSW		major angled open fracture
	LBT2	0.91	0.41	–0.91	NW–SE	NE		moderate-major open angled fracture
NN5								
		0.91	2.64	–1.98	N45E	SE	80	major open fracture, angled
		0.91	2.54	–1.98	N45E	SE	80	major open fracture, angled
		0.91	2.54	–1.98			90	major vertical fracture trending along strike of hole...
		0.91	2.26	–1.98			90	major vertical fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
								trending along strike of hole...
		0.91	2.24	–1.98	NW–SE	NE		moderate tight subvertical partly open fracture
		0.91	2.03	–1.98	NW–SE	NE		moderate tight subvertical partly open fracture
		0.91	2.03	–1.98	E–W		90	moderate vertical open fracture
		0.91	1.68	–1.98	E–W			minor tight subvertical fracture
		0.91	1.04	–1.98	E–W		90	moderate-major open vertical fracture
	LBT2	0.91	0.94	–1.98	N45W	NE	90	major open vertical fracture
	LBT2	0.91	0.94	–1.98	N45W	NE	90	major open vertical fracture
NN6								
		0.91	2.79	–3.81	N20E		90	angled tight fracture along the wall surface
		0.91	2.67	–3.81			90	minor vertical closed fracture
		0.91	2.54	–3.81			90	minor vertical closed fracture
		0.91	2.26	–3.81			90	major open vertical fracture
		0.91	2.07	–3.81	N–S	E	45	open fracture parallels the hole
		0.91	1.96	–3.81	N–S	E	45	open fracture parallels the hole
	LBT2	0.91	1.63	–3.81			90	major vertical(?) open fracture (is grout exiting fracture?)
		0.91	1.57	–3.81	N45W			major subvertical(?) angled open fracture
		0.91	1.24	–3.81	N30W	NW	90	angled major fracture
		0.91	1.04	–3.81	N30W	NW	90	angled major fracture
		0.91	1.14	–3.81	E–W	S	10	major subhorizontal open fracture
		0.91	0.81	–3.81	E–W	S	10	major subhorizontal open fracture
		0.91	0.81	–3.81	E–W	S	20	minor wandering subhorizontal fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		0.91	0.51	–3.81	E–W	S	20	minor wandering subhorizontal fracture
N01								
		2.13	2.64	–4.11	E–W	S	90	moderate-major open to partly open vertical fracture
		2.13	2.59	–4.11	E–W		90	moderate-major open to partly open vertical fracture
		2.13	2.08	–4.11	N70E		90	angled major open fracture
		2.13	2.04	–4.11	N70E		90	angled major open fracture
		2.13	1.74	–4.11	E–W		90	series of significant open fractures
		2.13	1.60	–4.11	E–W		90	series of significant open fractures
		2.13	1.45	–4.11	N20W		90	angled large fracture
		2.13	1.22	–4.11	N20W		90	angled large fracture
	LBT3	2.13	1.07	–4.11			90	minor vertical fracture, looks closed
		2.13	0.89	–4.11	N20W		90	angled moderate-minor tight closed fracture
		2.13	0.79	–4.11	N20W		90	angled moderate-minor tight closed fracture
		2.13	0.61	–4.11	N30E	NW		angled minor tight closed fracture
		2.13	0.56	–4.11	N30E	NW		angled minor tight closed fracture
		2.13	0.53	–4.11			90	minor vertical partly open fracture
		2.13	0.41	–4.11	E–W	S		closed subvertical fracture
		2.13	0.36	–4.11	E–W	S		closed subvertical fracture
N02								
		0.91	2.84	–4.11	N30E	SE	30	complex series of subhorizontal open fractures
		0.91	2.50	–4.11	N30E	SE	30	complex series of subhorizontal open fractures
		0.91	2.24	–4.11	N70E		90	significant open subvertical fracture
		0.91	1.73	–4.11	N60W	SW	70	minor angled closed fracture
		0.91	1.68	–4.11	N60W	SW	70	minor angled closed fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		0.91	1.55	–4.11			90	major open vertical fracture
		0.91	1.40	–4.11	N30W	SW	70	minor angled closed fracture
		0.91	1.30	–4.11	N30W	SW	70	minor angled closed fracture
		0.91	1.30	–4.11			90	minor vertical fracture
		0.91	1.30	–4.11	N30W	SW	80	angled moderate-minor partly open fracture
		0.91	1.17	–4.11	N30W	SW	80	angled moderate-minor partly open fracture
		0.91	1.14	–4.11	N30E	NW		angled minor-moderate vertical fracture
		0.91	0.97	–4.11	N30E	NW		angled minor-moderate vertical fracture
		0.91	0.97	–4.11			90	moderate vertical partly open fracture
		0.91	0.64	–4.11	NE–SW		90	moderate vertical partly open fracture
		0.91	0.66	–4.11	~N–S		90	major open angled vertical fracture-wandering
		0.91	0.43	–4.11	~N–S		90	major open angled vertical fracture-wandering
		0.91	0.43	–4.11	N30E	SE	80	angled fracture
		0.91	0.30	–4.11	N30E	SE	80	angled fracture
NT1								
	LBT22	2.74	2.97	–2.44	N30E	NW	70	angled fracture
	LBT22	2.74	2.84	–2.44	N30E	NW	70	angled fracture
		2.74	2.74	–2.44			90	moderate/major vertical open fracture
		2.74	2.26	–2.44	N70E	NW	80	angled minor fracture
		2.74	2.24	–2.44	N70E	NW	80	angled minor fracture
		2.74	2.13	–2.44	N70E	NW	80	angled minor fracture
		2.74	2.11	–2.44	N70E	NW	80	angled minor fracture
		2.74	2.13	–2.44	N60E	NW	80	angled minor fracture
		2.74	2.06	–2.44	N60E	NW	80	angled minor fracture
		2.74	2.11	–2.44	N30W	NW	80	moderate-major open fracture
		2.74	2.01	–2.44	N30W	NW	80	moderate-major open fracture
		2.74	1.91	–2.44	NE–SW	NW		minor tight angled fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.74	1.88	–2.44	NE–SW	NW		minor tight angled fracture
		2.74	1.80	–2.44			90	minor vertical tight fracture
		2.74	1.50	–2.44	N15W	SW	60	major angled open fracture
		2.74	1.24	–2.44	N15W	SW	60	major angled open fracture
		2.74	1.24	–2.44			90	minor vertical partly open fracture
		2.74	1.09	–2.44	N45E	SE	70	moderate partly open angled fracture
		2.74	1.03	–2.44	N45E	SE	70	moderate partly open angled fracture
	LBT3	2.74	0.94	–2.44			90	moderate open vertical wet fracture
NT2								
		0.91	2.41	–0.61	NW–SE			minor tight subvertical fracture
		0.91	2.31	–0.61			90	minor tight vertical fracture
		0.91	1.55	–0.61	NW–SE	SW		moderate open fracture
		0.91	1.32	–0.61	NW–SE	SW		moderate open fracture
		0.91	1.09	–0.61	E–W		90	minor vertical generally closed fracture
		0.91	1.07	–0.61	E–W		90	minor vertical generally closed fracture
		0.91	0.69	–0.61			90	minor vertical closed fracture
NT3								
		0.91	2.72	–3.20			90	tight, minor vertical fracture
		0.91	2.79	–3.20	N30W	NE	80	minor, subvertical fracture, angled
		0.91	2.72	–3.20	E–W	W		minor, subvertical fracture, angled
		0.91	2.41	–3.20	E–W		90	major, open vertical fracture
		0.91	1.85	–3.20	N45E	NW		minor-moderate subvertical fracture, partly open
		0.91	1.73	–3.20	N45E	NW		minor-moderate subvertical fracture, partly open
		0.91	1.73	–3.20	E–W		90	major open vertical fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		0.91	1.52	–3.20	E–W	SE/S		moderate-major open subvertical fracture
		0.91	1.35	–3.20	NW–SE	SW	90	moderate-major open vertical fracture
		0.91	1.17	–3.20				minor subvertical closed fracture
		0.91	0.97	–3.20	E–W		90	moderate vertical fracture, partly open
NT4								
	LBT24	0.30	2.46	–2.44	NE–SW	NW	70	major-moderate angled sharp open fracture
	LBT24	0.30	2.41	–2.44	NE–SW	NW	70	major-moderate angled sharp open fracture
		0.30	2.44	–2.44	NE–SW	NW	70	major-moderate angled sharp open fracture
		0.30	2.39	–2.44	NE–SW	NW	70	major-moderate angled sharp open fracture
		0.30	2.39	–2.44	NE–SW	NW	70	major-moderate angled sharp open fracture
		0.30	2.34	–2.44	NE–SW	NW	70	major-moderate angled sharp open fracture
		0.30	2.03	–2.44	NE–SW	NW	80	moderate angled partly open fracture
		0.30	2.01	–2.44	NE–SW	NW	80	moderate angled partly open fracture
		0.30	1.98	–2.44	N80E			major open vertical-subvertical fracture
		0.30	1.85	–2.44	N20E	NW	45	moderate-major discrete sharp partly open/closed
		0.30	1.68	–2.44	N20E	NW	45	moderate-major discrete sharp partly open/closed
	LBT23	0.30	1.35	–2.44	NE–SW	NW	45	major partly open fracture
	LBT23	0.30	0.89	–2.44	NE–SW	NW	45	major partly open fracture
	LBT3	0.30	1.02	–2.44			90	moderate open vertical fracture
		0.30	0.86	–2.44	NW–SE	SW	55	minor tight/healed angled fracture
		0.30	0.71	–2.44	NW–SE	SW	55	minor tight/healed angled fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
WH1								
	LBT16(?)	0.66	1.68	–1.22			90	major open vertical fracture
		1.09	1.68	–1.22	SW–NE	E?		angled minor/moderate subhorizontal party open fracture
		1.78	1.68	–1.22			90	minor vertical partly open fracture
		2.08	1.68	–1.22	~SW–NE	E		moderate subhorizontal closed fracture
		2.18	1.68	–1.22	~SW–NE	E		moderate subhorizontal closed fracture
WH2								
		0.48	1.68	–2.29			90	minor tight vertical fracture
		0.69	1.68	–2.29	NE–SW		90	minor tight vertical fracture
		1.27	1.68	–2.29			90	minor tight vertical fracture
		1.47	1.68	–2.29	N–S		90	major open wet vertical fracture
		1.83	1.68	–2.29			90	minor tight vertical fracture
		1.98	1.68	–2.29			90	minor tight vertical fracture
		2.41	1.68	–2.29	NW–SE	SW		moderate tight (?) fracture
		2.77	1.68	–2.29	NW–SE	SW		moderate tight (?) fracture
		2.49	1.68	–2.29			90	minor tight vertical fracture
WM1								
		1.78	2.13	–3.96		E–NE		major(?) subhorizontal fracture, partly open
		2.13	2.13	–3.96		E–NE		major(?) subhorizontal fracture, partly open
		2.67	2.13	–3.96			90	moderate-major vertical open fracture
		2.44	2.13	–3.96			90	minor vertical closed fracture
		2.34	2.13	–3.96			90	major vertical open fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.55	2.13	–3.96			90	major open vertical fracture
		1.50	2.13	–3.96			90	major open vertical fracture
		1.55	2.13	–3.96				series of generally minor vertical to subvertical tight fractures
		1.09	2.13	–3.96				series of generally minor vertical to subvertical tight fractures
		0.81	2.13	–3.96	NE–SW	SW		moderate partly open subvertical fracture
	LBT2	0.53	2.13	–3.96	N–S		90	minor vertical fracture
		0.15	2.13	–3.96			90	moderate-major vertical open fracture
WM1?								
		0.43	2.13	–3.96				minor tight subvertical/vertical fracture
		0.66	2.13	–3.96	N–S		90	minor tight vertical fracture
		1.09	2.13	–3.96			90	minor vertical tight fracture
		1.35	2.13	–3.96			90	minor vertical tight fracture
		1.77	2.13	–3.96			90	minor vertical tight fracture
		2.06	2.13	–3.96			90	minor vertical tight fracture
		2.34	2.13	–3.96	N45W	SW	70	angled major open fracture
		2.41	2.13	–3.96	N45W	SW	70	angled major open fracture
		2.46	2.13	–3.96				major open vertical/subvertical fracture—rubbly
		2.46	2.13	–3.96				major series of horizontal to subhorizontal open fractures
		2.77	2.13	–3.96				major series of horizontal to subhorizontal open fractures

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
WM2								
	LBT2	0.66	0.91	–1.22				moderate subhorizontal fracture—hard to see
		0.97	0.91	–1.22	N20W	NE	20	major subhorizontal closed to open fracture
		1.52	0.91	–1.22	N20W	NE	20	major subhorizontal closed to open fracture
		1.80	0.91	–1.22				minor mostly closed vertical fracture
		2.08	0.91	–1.22			90	minor vertical closed fracture
		2.41	0.91	–1.22			90	minor vertical closed fracture
WM3	cannot see the depths on tape							
WN2								
		0.10	2.13	–1.68	N30E	SE	70	angled minor closed/healed subvertical fracture
		0.13	2.13	–1.68	N30E	SE	70	angled minor closed/healed subvertical fracture
		0.20	2.13	–1.68			90	minor vertical fracture
		0.51	2.13	–1.68	~N–S	W	80	major open fracture, with some associated fractures
		0.53	2.13	–1.68	~N–S	W	80	major open fracture, with some associated fractures
		0.84	2.13	–1.68	N45W	SW	40	major angled open to partly open fracture
		0.66	2.13	–1.68	N45W	SW	40	major angled open to partly open fracture
		1.04	2.13	–1.68			90	minor vertical closed fracture
		1.24	2.13	–1.68			90	minor vertical closed fracture
		1.27	2.13	–1.68	N–S	W	20	major/moderate angled long fracture, healed
	LBT12(?)	1.55	2.13	–1.68	N–S	W	20	major/moderate angled long fracture, healed
		1.47	2.13	–1.68			90	major open vertical fracture
		1.65	2.13	–1.68			90	moderate vertical partly open fracture (displaced by a fault)

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
	LBT13(?)	1.80	2.13	–1.68	N80W	SW	70	major? long angled fracture/fault?
	LBT13(?)	1.55	2.13	–1.68	N80W	SW	70	major? long angled fracture/fault?
		1.75	2.13	–1.68			90	minor vertical fracture (displaced by fault)
		2.03	2.13	–1.68			90	minor vertical closed fracture
		2.29	2.13	–1.68			90	moderate vertical sharp open fracture
		2.62	2.13	–1.68				minor subvertical closed fracture
WN3								
	LBT2	0.88	1.68	–3.96			90	major vertical open wet fracture
		1.00	1.68	–3.96			90	Sharp open wet vertical moderate fracture
		1.21	1.68	–3.96			90	major open wet vertical fracture
		1.35	1.68	–3.96			90	major open wet vertical fracture
		2.77	1.68	–3.96			90	vertical fracture—gaping hole
		1.30	1.68	–3.96	N70E	SE	80	top sharp open fracture
		1.50	1.68	–3.96	N70E	SE	80	base sharp open fracture
		1.50	1.68	–3.96	N60W	W	45	top moderate partially open fracture (shallow)
		1.63	1.68	–3.96	N60W	W	45	base moderate partially open fracture (shallow)
		1.55	1.68	–3.96		W		subvertical partially open fracture
		1.88	1.68	–3.96				subvertical moderate wet open fracture
		1.96	1.68	–3.96	N70W	SW	80	top major partly open angled fracture
		2.34	1.68	–3.96	N70W	SW	80	base major partly open angled fracture
		2.11	1.68	–3.96				major subvertical open wet fracture
		2.34	1.68	–3.96				major subvertical open wet fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.55	1.68	–3.96	N45W	SW	70	top tight closed fracture
		2.59	1.68	–3.96	N45W	SW	70	base tight closed fracture
		2.67	1.68	–3.96				top subvertical wet open fracture
		2.69	1.68	–3.96				base subvertical wet open fracture
WN4								
		0.56	0.91	–1.68			90	minor sharp vertical fracture, thin maybe partly open
		0.76	0.91	–1.68	NW–SE	NE		major partly open fracture
	LBT2	0.80	0.91	–1.68	NW–SE	NE		major partly open fracture
		1.50	0.91	–1.68	N–S	S	45	major partly open angled fracture
		1.57	0.91	–1.68	N–S	S	45	major partly open angled fracture
		1.70	0.91	–1.68			90	moderate vertical open fracture
		1.75	0.91	–1.68	N–S		90	minor vertical fracture
		1.78	0.91	–1.68	N–S		90	minor vertical fracture
		2.01	0.91	–1.68			90	vertical mostly closed fracture
		2.03	0.91	–1.68			90	minor tight vertical fracture
		2.31	0.91	–1.68			90	moderate sharp, vertical open fracture, wet?
W05								
		0.09	0.91	–3.96			90	vertical moderate wet open fracture
		0.10	0.91	–3.96	N–S	W		top shallow tight fracture
		0.14	0.91	–3.96	N05E	NW	20	base major open angled wet fracture
		0.25	0.91	–3.96	N05E	NW	20	top major open angled wet fracture
		0.42	0.91	–3.96	NW–SE			generally minor subvertical tight fracture
		0.55	0.91	–3.96	NE–SW	NW		base angled tight fracture (top not seen)
		0.58	0.91	–3.96	N30W	NE	80	moderate wet open fracture
		0.61	0.91	–3.96	N30W	NE	80	moderate wet open fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		0.61	0.91	–3.96	N–S			subvertical tight minor fracture
		0.64	0.91	–3.96	~E–W		90	base major open angled fracture wet alteration halo
		1.17	0.91	–3.96	~E–W			top major wandering subvertical fracture
		0.72	0.91	–3.96	N–S?			partly open wet minor subvertical fracture on north side of hole
		0.79	0.91	–3.96				major? open wet subvertical fracture
		0.93	0.91	–3.96	N–S			major? open wet subvertical fracture
		0.99	0.91	–3.96	N–S?			minor wet partly open fracture subvertical on north side of hole
		1.08	0.91	–3.96	N–S			moderate partly open wet subvertical fracture
		1.46	0.91	–3.96			90	fracture zone wet open some vertical and angled
		1.32	0.91	–3.96			90	fracture zone wet open some vertical and angled
		1.60	0.91	–3.96				subvertical major? open? fracture along the north wall
		1.52	0.91	–3.96				subvertical major? open? fracture along the north wall
		1.63	0.91	–3.96				small patch of same subvertical major? open? fracture along the north wall
		1.73	0.91	–3.96	N–S			tight subvertical fracture mainly on the north side of hole
		1.84	0.91	–3.96	N45W	SW	45	tight minor angled fracture
		1.91	0.91	–3.96	N45W	SW	45	tight minor angled fracture
		1.88	0.91	–3.96	N–S			subvertical partly open wet fracture
		2.25	0.91	–3.96	N–S			major open wet subvertical fracture
		2.32	0.91	–3.96	N–S			major open wet subvertical fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.53	0.91	–3.96	N–S			subvertical tight fracture
WT1?								
		0.79	1.68	–0.76	N20E	SE	80	major open subvertical fracture
		1.14	1.68	–0.76			90	minor tight vertical fracture
		1.85	1.68	–0.76			90	moderate open wet vertical fracture
		1.88	1.68	–0.76				minor tight subvertical fracture
		2.08	1.68	–0.76				moderate sharp subvertical open wet fracture
WT2								
	LBT2	0.23	1.68	–1.68	~N–S	E	80	subvertical angled moderate, partly open fracture
	LBT2	0.25	1.68	–1.68	~N–S	E	80	subvertical angled moderate, partly open fracture
		0.51	1.68	–1.68			90	vertical, moderate-major fracture
		1.04	1.68	–1.68	N60E	SE	80	sharp angled minor-moderate, open fracture
		1.09	1.68	–1.68	N60E	SE	80	sharp angled minor-moderate, open fracture
		1.57	1.68	–1.68	N–S	W		moderate subvertical open fracture
	LBT12(?)	1.60	1.68	–1.68	N–S	W	90	moderate vertical open fracture, but less open
		1.70	1.68	–1.68	N20W	E	80	minor subvertical fracture
		1.85	1.68	–1.68			90	minor tight vertical fracture
WT3								
		0.11	1.68	–3.05			90	top zone vertical fractures
		0.20	1.68	–3.05			90	base zone vertical fractures
	LBT 2	0.66	1.68	–3.05	N20W		90	open, wet vertical fracture
		0.81	1.68	–3.05	N20W	E		top tight subhorizontal
		0.85	1.68	–3.05	N20W	E		base tight subhorizontal
		0.94	1.68	–3.05	N20W	W	90	top partly open, vertical fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		0.99	1.68	–3.05	N20W	W	90	base partly open, vertical fracture
		1.12	1.68	–3.05	N50W	S	45	moderate
		1.27	1.68	–3.05	N50W	S	45	moderate
		1.30	1.68	–3.05	N70E	N	80	top fracture (cannot see base)
		1.33	1.68	–3.05	N–S		90	vertical, wet, open fracture
	LBT13	1.65	1.68	–3.05	N30W	W		top subvertical fracture
	LBT13	1.68	1.68	–3.05	N30W	W		base subvertical fracture
		1.65	1.68	–3.05	N–S	E		top open, wet, subhorizontal
		1.79	1.68	–3.05	N–S	E		base open, wet, subhorizontal
		2.25	1.68	–3.05	N10W		90	fracture
		2.25	1.68	–3.05	N60W	S	70	top open, wet fracture
		2.36	1.68	–3.05	N60W	S	70	base open, wet fracture
		2.46	1.68	–3.05	N–S		90	vertical fracture
		2.51	1.68	–3.05	N–S		90	tight, vertical fracture
		2.59	1.68	–3.05	N10W	S	80	top tight fracture
		2.51	1.68	–3.05	N10W	S	80	base tight fracture
		2.74	1.68	–3.05			90	open vertical, wet fracture
UE25FRPTC#1								
	LBT8	1.22	2.73	–2.29			subvert	top major open/closed fracture
	LBT8	1.22	2.60	–2.29			subvert	base major open/closed fracture
		1.22	2.57	–2.29			90	minor closed fracture
		1.22	1.85	–2.29				major open void/clean fracture
		1.22	1.72	–2.29				hole intersection fracture
		1.22	1.26	–2.29			subhor	top moderate-major closed fracture
		1.22	1.06	–2.29			subhor	base moderate-major closed fracture
	LBT3	1.22	1.06	–2.29			90	moderate-major open/closed fracture
	LBT33	1.22	0.93	–2.29			subhor	top minor-moderate closed fracture
	LBT33	1.22	0.46	–2.29			subhor	base minor-moderate closed fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
	LBT2	1.22	0.67	–2.29			90	top moderate closed fracture
	LBT2	1.22	0.54	–2.29			90	base moderate closed fracture
		1.22	0.21	–2.29			90	top minor-moderate closed fracture
		1.22	0.08	–2.29			90	base minor-moderate closed fracture
UE25FRPTC#2								
		1.22	3.03	–2.01			~90	top major open fracture
		1.22	2.91	–1.99			~90	base major open fracture
		1.22	2.78	–1.97			subhor	top minor closed fracture
		1.22	2.60	–1.94			subhor	base minor closed fracture
		1.22	2.48	–1.92				pre-test borehole
		1.22	1.95	–1.82			90	minor-moderate closed fracture
		1.22	1.79	–1.80				pre-test borehole
		1.22	1.24	–1.70				pre-test borehole
		1.22	1.04	–1.66			90	moderate open fracture
		1.22	0.86	–1.63			subhor	top major open fracture
		1.22	0.56	–1.58			subhor	base major open fracture
		1.22	0.71	–1.60			~45	top moderate closed fracture
		1.22	0.45	–1.56			~45	base moderate closed fracture
		1.22	0.58	–1.58				pre-test borehole
	LBT2	1.22	0.43	–1.56			~45	top moderate-major closed/open fracture
	LBT2	1.22	0.23	–1.52			~45	base moderate-major closed/open fracture
UE25FRPTC#3								
		1.22	2.99	–2.56			~90	top moderate-major open/closed fracture
		1.22	2.64	–2.63			~90	base moderate-major open/closed fracture
		1.22	2.49	–2.65			~90	minor-moderate closed fracture
		1.22	2.47	–2.66			subvert	top moderate open/closed fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.22	2.37	–2.67			subvert	base moderate open/closed fracture
		1.22	2.29	–2.69				post-test borehole
		1.22	2.04	–2.73				post-test borehole
		1.22	1.92	–2.75				post-test borehole
		1.22	1.85	–2.77				post-test borehole
		1.22	2.02	–2.74			subvert	top minor closed fracture
		1.22	1.87	–2.76			subvert	base minor closed fracture
		1.22	1.97	–2.74			subhor	top major open fracture
		1.22	1.82	–2.77			subhor	base major open fracture
		1.22	1.85	–2.77				possible major open subvertical fracture
		1.22	1.75	–2.78			90	minor closed fracture
	LBT23	1.22	1.75	–2.78			~45	top minor open/closed fracture
	LBT23	1.22	1.55	–2.82			~45	base minor open/closed fracture
		1.22	1.57	–2.82				horizontal borehole intersection
		1.22	1.25	–2.87				vertical borehole intersection
		1.22	1.50	–2.83			subvert	top minor closed fracture
		1.22	1.20	–2.88			subvert	base minor closed fracture
		1.22	1.27	–2.87			subvert	top minor closed fracture
		1.22	1.12	–2.89			subvert	base minor closed fracture
	LBT3	1.22	1.07	–2.90			90	moderate open/closed fracture
		1.22	1.00	–2.92			subvert	top minor fracture
	LBT2	1.22	0.92	–2.93			subvert	top moderate open fracture
	LBT2	1.22	0.80	–2.95			subvert	base moderate open fracture
		1.22	0.62	–2.98				vertical borehole intersection
		1.22	0.10	–3.07			subvert	top major open/closed fracture
		1.22	0.00	–3.09			subvert	base major open/closed fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
UE25FRPTC#4								
		1.22	2.44	–1.51				pre-test borehole
		1.22	2.04	–1.37			~90	moderate open/closed fracture
		1.22	1.74	–1.25				post-test borehole
		1.22	1.64	–1.22				post-test borehole
		1.22	1.24	–1.08			~45	minor-moderate ? fracture
	LBT3	1.22	0.94	–0.96			subhor	top major open fracture
	LBT3	1.22	1.13	–1.03			subhor	base major open fracture
		1.22	0.59	–0.84				pre-test borehole
		1.22	0.47	–0.79			angled	top major open fracture
		1.22	0.26	–0.72			angled	base major open fracture
UE25FRPTC#5								
		1.22	2.96	–2.87			~90	major open fracture
		1.22	2.60	–3.00			~90	major open fracture
	LBT8	1.22	2.60	–3.00			90	moderate open/closed fracture
		1.22	2.55	–3.02				pre-test borehole
	LBT19(?)	1.22	2.55	–3.02			~80	top moderate open fracture
	LBT19(?)	1.22	2.34	–3.10			~80	base moderate open fracture
	LBT8	1.22	2.58	–3.01			~80	top moderate open/closed fracture
	LBT8	1.22	2.24	–3.13			~80	base moderate open/closed fracture
	LBT12	1.22	2.10	–3.19			~90	top minor-moderate closed fracture
	LBT12	1.22	2.02	–3.21			~90	base minor-moderate closed fracture
		1.22	1.97	–3.23				post-test borehole
		1.22	1.90	–3.26				post-test borehole
		1.22	1.83	–3.28			~90	top minor-moderate open/closed fracture
		1.22	1.78	–3.30			~90	base minor-moderate open/closed fracture
		1.22	1.73	–3.32			~90	top minor-moderate open/closed fracture
		1.22	1.71	–3.33			~90	base minor-moderate open/closed fracture
	LBT12(?)	1.22	1.69	–3.34			~80	top moderate open fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
	LBT12(?)	1.22	1.47	–3.42			~80	base moderate open fracture
	LBT12(?)	1.22	1.61	–3.36			~80	top major open fracture
	LBT12(?)	1.22	1.18	–3.52			~80	base major open fracture
		1.22	1.30	–3.48				pre-test borehole
	LBT2	1.22	1.18	–3.52			~70	top moderate-major open fracture
	LBT2	1.22	1.11	–3.55			~70	base moderate-major open fracture
		1.22	1.04	–3.57			~90	moderate open/closed fracture
		1.22	0.65	–3.71				pre-test borehole
		1.22	0.63	–3.72			subhor	top major open/closed fracture
		1.22	0.29	–3.84			subhor	base major open/closed fracture
	LBT15	1.22	0.48	–3.77			~80	top minor closed fracture
	LBT15	1.22	0.36	–3.82			~80	base minor closed fracture
		1.22	0.05	–3.93				possible breakout or fracture
UE25FRPTC#6								
		1.22	3.04	–1.40			subvert	top minor/tight closed fracture
		1.22	2.67	–1.19			subvert	base minor/tight closed fracture
		1.22	2.44	–1.05				pre-test borehole
		1.22	1.88	–0.73				pre-test borehole
	LBT1(?)	1.22	1.64	–0.59				top major open fracture
	LBT1(?)	1.22	1.30	–0.40				base major open fracture
		1.22	1.25	–0.37				pre-test borehole
	LBT1(?)	1.22	1.21	–0.35			subvert	top minor-moderate open/closed fracture
	LBT1(?)	1.22	1.17	–0.32			subvert	base minor-moderate open/closed fracture
	LBT3	1.22	1.15	–0.31			subvert	top minor-moderate fracture
		1.22	1.10	–0.29			subvert	base minor-moderate fracture
		1.22	1.08	–0.27			~90	minor closed fracture
		1.22	0.87	–0.15			~90	minor closed fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
UE25FRPTC#7		very dirty hole with mudcake on the walls						
		1.22	2.75	–4.05				pre-test borehole
		1.22	2.55	–4.24				pre-test borehole
	LBT8	1.22	2.18	–4.59			~60	top minor closed fracture
	LBT8	1.22	2.09	–4.68			~60	base minor closed fracture
		1.22	1.91	–4.86				pre-test borehole
		1.22	1.89	–4.87			~60	top minor closed fracture
		1.22	1.82	–4.94			~60	base minor closed fracture
		1.22	1.78	–4.98			~60	top minor closed fracture
		1.22	1.71	–5.05			~60	base minor closed fracture
		1.22	1.44	–5.31			subhor	top moderate closed fracture
		1.22	1.31	–5.44			subhor	base moderate closed fracture
		1.22	1.00	–5.74			~60	top minor closed fracture
		1.22	0.96	–5.77			~60	base minor closed fracture
		1.22	0.91	–5.82			subvert	top minor closed fracture
		1.22	0.69	–6.03			subvert	base minor closed fracture
		1.22	0.71	–6.02			subvert	major open fracture
		1.22	0.44	–6.28			subvert	major open fracture
UE25FRPTC#8								
		1.22	2.57	–0.61			~45	top major closed fracture
		1.22	2.41	–0.48			~45	base major closed fracture
	LBT1	1.22	2.45	–0.51			~45	top major open/closed fracture
	LBT1	1.22	2.35	–0.43			~45	base major open/closed fracture
		1.22	2.37	–0.44				pre-test borehole
		1.22	2.37	–0.44			90	minor-moderate fracture
	LBT16(?)	1.22	2.22	–0.31				top minor closed fracture
	LBT16(?)	1.22	2.08	–0.20				base minor closed fracture
		1.22	2.24	–0.33			~80	top minor-moderate closed fracture
		1.22	1.98	–0.11			~80	base minor-moderate closed fracture
UE25FRPTC#9		locally muddy hole(covering tape)						
		1.75	2.70	–2.29			90	moderate open/closed Discrete fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.82	2.48	–2.29				post-test borehole
	LBT8	1.85	2.36	–2.29			~45	top minor closed fracture
	LBT8	1.87	2.29	–2.29			~45	base minor closed fracture
		1.87	2.29	–2.29				top minor closed fracture
		1.91	2.16	–2.29				base minor closed fracture
		1.99	1.89	–2.29			~90	minor closed fracture
		2.02	1.77	–2.29				post-test borehole
		2.07	1.60	–2.29				pre-test borehole
		2.53	0.00	–2.29			~80	top minor closed fracture
		2.16	1.28	–2.29			~80	base minor closed fracture
		2.21	1.13	–2.29			~85	major open fracture
		2.33	0.69	–2.29			~80	top minor closed fracture
		2.36	0.59	–2.29			~80	base minor closed fracture
UE25FRPTC#10		difficult hole to log						
	LBT1(?)	0.88	1.83	–0.41			~90	top major open fracture
		0.98	1.83	–0.33			~90	base major open fracture
		1.15	1.83	–0.20				pre-test borehole
UE25FRPTC#11								pre-test borehole
		0.24	1.83	–1.14			~45	top major open/closed fracture
		0.33	1.83	–1.08			~45	base major open/closed fracture
	LBT16(?)	1.05	1.83	–0.62			~45	top minor-moderate closed fracture
	LBT16(?)	1.14	1.83	–0.55			~45	base minor-moderate closed fracture
		1.55	1.83	–0.29				pre-test borehole
UE25FRPTC#12								
		0.10	1.83	–1.46			subvert	top major closed fracture
		0.14	1.83	–1.44			subvert	base major closed fracture
		0.24	1.83	–1.39			~90	minor closed fracture
		0.38	1.83	–1.32				pre-test borehole
	LBT20(?)	0.43	1.83	–1.29			~45	top moderate-major open fracture
	LBT20(?)	0.59	1.83	–1.21			~45	base moderate-major open fracture
		1.06	1.83	–0.97				pre-test borehole
	LBT16(?)	0.87	1.83	–1.07			~30	top minor closed fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
	LBT16(?)	1.25	1.83	–0.87			~30	base minor closed fracture
		1.32	1.83	–0.84				post-test borehole
		1.41	1.83	–0.79				post-test borehole
	LBT1	1.77	1.83	–0.61			subhor	top major open! fracture
	LBT1	1.91	1.83	–0.54			subhor	base major open! fracture
		1.98	1.83	–0.50				pre-test borehole
		2.28	1.83	–0.35			subhor	top moderate closed fracture
		2.40	1.83	–0.29			subhor	base moderate closed fracture
		2.45	1.83	–0.26				top moderate closed fracture
		2.61	1.83	–0.18				base moderate closed fracture
		2.59	1.83	–0.19				pre-test borehole
UE25FRPTC#13								
		-0.05	1.83	–1.75			subvert	top minor-moderate open/closed fracture
		0.03	1.83	–1.72			subvert	base minor-moderate open/closed fracture
	LBT20(?)	0.45	1.83	–1.57			~90	minor-moderate fracture
		1.03	1.83	–1.35				post-test borehole
		1.08	1.83	–1.34				pre-test borehole
		1.72	1.83	–1.10				pre-test borehole
		2.36	1.83	–0.87				pre-test borehole
	LBT1(?)	2.53	1.83	–0.81			subhor	top major open/closed fracture
	LBT1(?)	2.39	1.83	–0.86			subhor	base major open/closed fracture
UE25FRPTC#14								
	LBT2	0.14	1.83	–1.87			~90	top major open fracture
	LBT2	0.21	1.83	–1.85			~90	base major open fracture
		1.22	1.83	–1.60				pre-test borehole
	LBT12	1.57	1.83	–1.51			~45	top major open fracture
	LBT12	1.69	1.83	–1.48			~45	base major open fracture
		1.77	1.83	–1.47				pre-test borehole
	LBT13	1.84	1.83	–1.45			~45	top minor closed fracture
	LBT13	1.99	1.83	–1.41			~45	base minor closed fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		2.43	1.83	–1.30				pre-test borehole
		2.51	1.83	–1.28			~45	top minor-moderate open/closed fracture
		2.63	1.83	–1.25			~45	base minor-moderate open/closed fracture
		2.60	1.83	–1.26			~45	top minor-moderate open/closed fracture
		2.73	1.83	–1.23			~45	base minor-moderate open/closed fracture
		2.73	1.83	–1.23			~60	top minor-moderate open/closed fracture
		2.80	1.83	–1.21			~60	base minor-moderate open/closed fracture
UE25FRPTC#15								
	LBT20	0.16	1.83	–2.26			~90	top major open fracture
	LBT20	0.51	1.83	–2.25			~90	base major open fracture
	LBT2(?)	0.35	1.83	–2.25			90	top moderate closed fracture
	LBT2(?)	0.93	1.83	–2.24			~80	base moderate closed fracture
		1.12	1.83	–2.24				
		1.06	1.83	–2.24			subvert	top moderate-major closed fracture
		1.57	1.83	–2.23			subvert	base moderate-major closed fracture
		1.78	1.83	–2.23				post-test borehole
		1.91	1.83	–2.23				post-test borehole
		1.96	1.83	–2.23			subvert	top moderate closed fracture
		2.41	1.83	–2.22			subvert	base moderate closed fracture
		2.41	1.83	–2.22				pre-test borehole
UE25FRPTC#16								
	LBT20(?)	0.24	1.83	–2.60			~90	minor closed fracture
	LBT2	0.37	1.83	–2.62			subvert	top moderate open/closed fracture
	LBT2	0.45	1.83	–2.63			subvert	base moderate open/closed fracture
		0.52	1.83	–2.65				pre-test borehole
	LBT23(?)	0.57	1.83	–2.66			subvert	top moderate closed

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
								fracture
	LBT23(?)	0.93	1.83	–2.72			subvert	base moderate closed fracture
		1.15	1.83	–2.76				post-test borehole
		1.28	1.83	–2.78			~90	minor-moderate closed fracture
		1.58	1.83	–2.83			subvert	top moderate open/closed fracture
		1.63	1.83	–2.84			subvert	base moderate open/closed fracture
		1.73	1.83	–2.86				post-test borehole
		2.01	1.83	–2.91			~90	major open/closed fracture
		2.39	1.83	–2.98				pre-test borehole
		2.19	1.83	–2.94			90	minor closed fracture
	LBT8	2.74	1.83	–3.04			90	minor-moderate open/closed fracture
UE25FRPTC#17								
		0.06	1.83	–2.86				moderate-major open fracture
		0.39	1.83	–2.98			subvert	major open fracture
		0.18	1.83	–2.90			~90	top major open! fracture
		0.63	1.83	–3.07			~90	base major open! fracture
		0.39	1.83	–2.98			subvert	top moderate-major open fracture
		0.46	1.83	–3.01			subvert	base moderate-major open fracture
		0.80	1.83	–3.13			subvert	top moderate-major open fracture
		0.94	1.83	–3.18			subvert	base moderate-major open fracture
		1.13	1.83	–3.25				post-test borehole
		1.28	1.83	–3.31			subvert	moderate-major fracture
	LBT13	1.47	1.83	–3.38			subvert	major! open/closed fracture
	LBT13	1.56	1.83	–3.41			subvert	major! open/closed fracture
		1.68	1.83	–3.45				post-test borehole
		1.68	1.83	–3.45			subvert	minor-moderate closed fracture
		2.02	1.83	–3.58			subvert	minor-moderate closed fracture
		1.85	1.83	–3.51			subvert	minor closed fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		1.90	1.83	–3.53			subvert	minor closed fracture
		2.09	1.83	–3.60			subvert	moderate closed fracture
		2.83	1.83	–3.87			subvert	moderate closed fracture
		2.02	1.83	–3.58				pre-test borehole
		2.43	1.83	–3.72			subvert	moderate closed fracture
		2.93	1.83	–3.91			subvert	moderate closed fracture
		2.71	1.83	–3.83				pre-test borehole
UE25FRPTC#18								
		0.45	1.83	–3.67			~subver	minor fracture
	LBT30(?)	0.75	1.83	–3.87			subhor	top moderate open/closed fracture
	LBT30(?)	0.93	1.83	–4.01			subhor	base moderate open/closed fracture
		0.85	1.83	–3.95			~50	top minor closed fracture
		0.98	1.83	–4.04			~50	base minor closed fracture
	LBT22(?)	0.89	1.83	–3.98			subhor	top minor closed fracture
	LBT22(?)	1.00	1.83	–4.05			subhor	base minor closed fracture
		1.37	1.83	–4.31			subvert	top moderate closed fracture
		1.48	1.83	–4.39			subvert	base moderate closed fracture
		1.52	1.83	–4.42			subvert	top moderate open fracture
		1.56	1.83	–4.45			subvert	base moderate open fracture
		1.62	1.83	–4.49			subvert	top minor open/closed fracture
		1.65	1.83	–4.51			subvert	base minor open/closed fracture
		1.73	1.83	–4.56			subvert	top minor open/closed fracture
		1.81	1.83	–4.62			subvert	base minor open/closed fracture
		2.00	1.83	–4.75				post-test borehole
		2.59	1.83	–5.16				pre-test borehole
UE25FRPTC#19								
		0.27	1.83	–2.16			subvert	top moderate-major fracture
		0.38	1.83	–2.15			subvert	base moderate-major fracture
		0.45	1.83	–2.15			subvert	top minor fracture

Hole	Surface Feature	Model East	Model North	Model Depth	Strike Direct	Dip Direct	Dip	Comments
		0.50	1.83	–2.14			subvert	base minor fracture
		1.06	1.83	–2.11			subvert	top minor fracture
		1.16	1.83	–2.10			subvert	base minor fracture
		1.46	1.83	–2.08			90	major fracture
		1.74	1.83	–2.06				pre-test borehole
		2.12	1.83	–2.03				pre-test borehole
		2.69	1.83	–1.99			~90	top major fracture
		2.80	1.83	–1.98			~90	base major fracture
UE25FRPTC#19a								
		0.46	1.26	–2.15				pre-test borehole
	LBT20(?)	0.54	1.24	–2.14			~90	top major open fracture
	LBT20(?)	0.64	1.21	–2.13			~90	base major open fracture
		0.85	1.15	–2.12				pre-test borehole
	LBT3	1.00	1.10	–2.11			~90	top major open fracture
	LBT3	1.23	1.04	–2.09			~90	base major open fracture
		1.62	0.93	–2.07			~90	moderate-major open/closed fracture
		2.01	0.82	–2.04			subhor	top moderate fracture
		2.17	0.77	–2.03			subhor	base moderate fracture
		2.12	0.79	–2.03				pre-test borehole

Appendix B
Figures

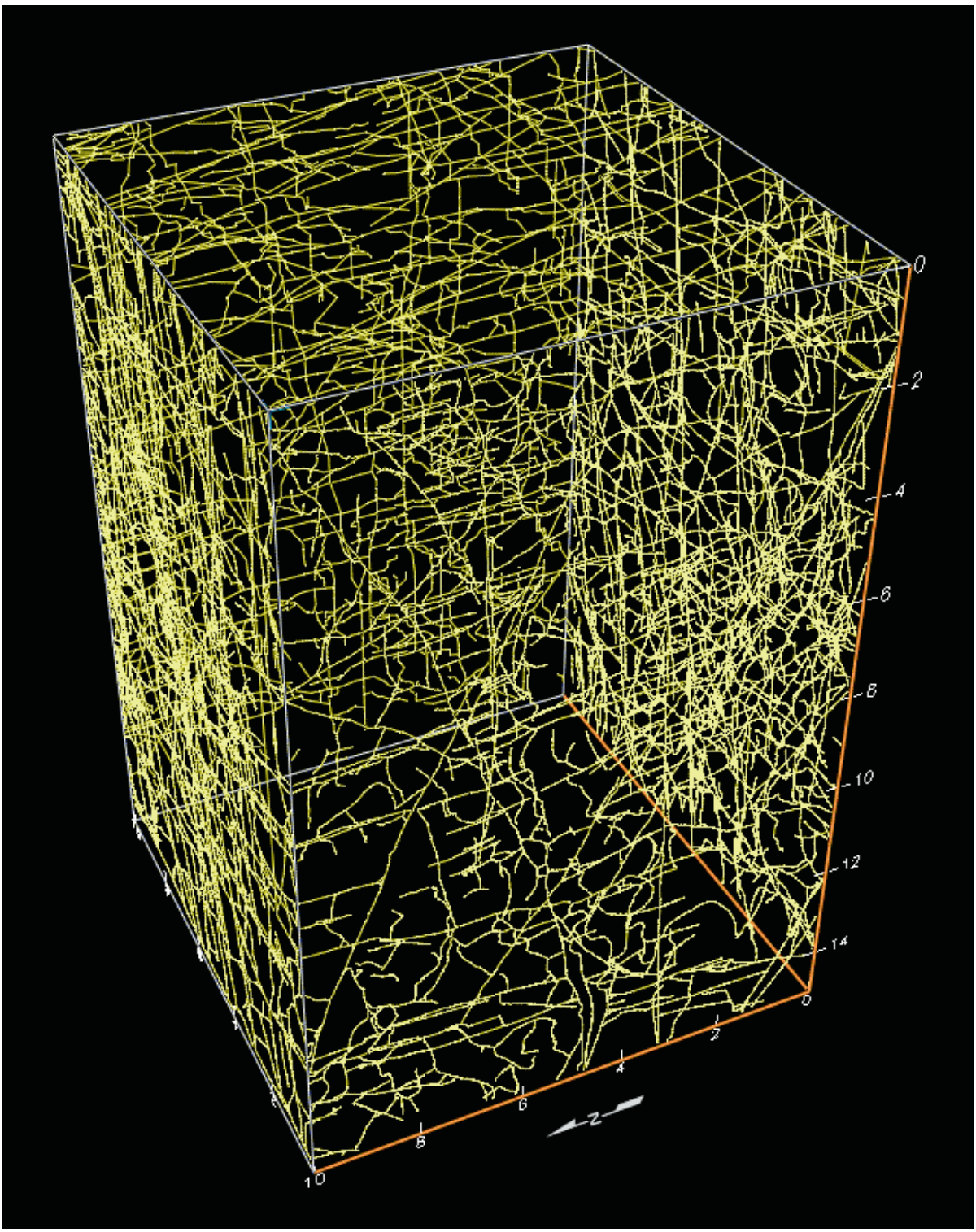

Figure 1. Mapped surface fractures on the large block: vertical and horizontal scales, in English units (ft), are equal and marked on the edges of the block.

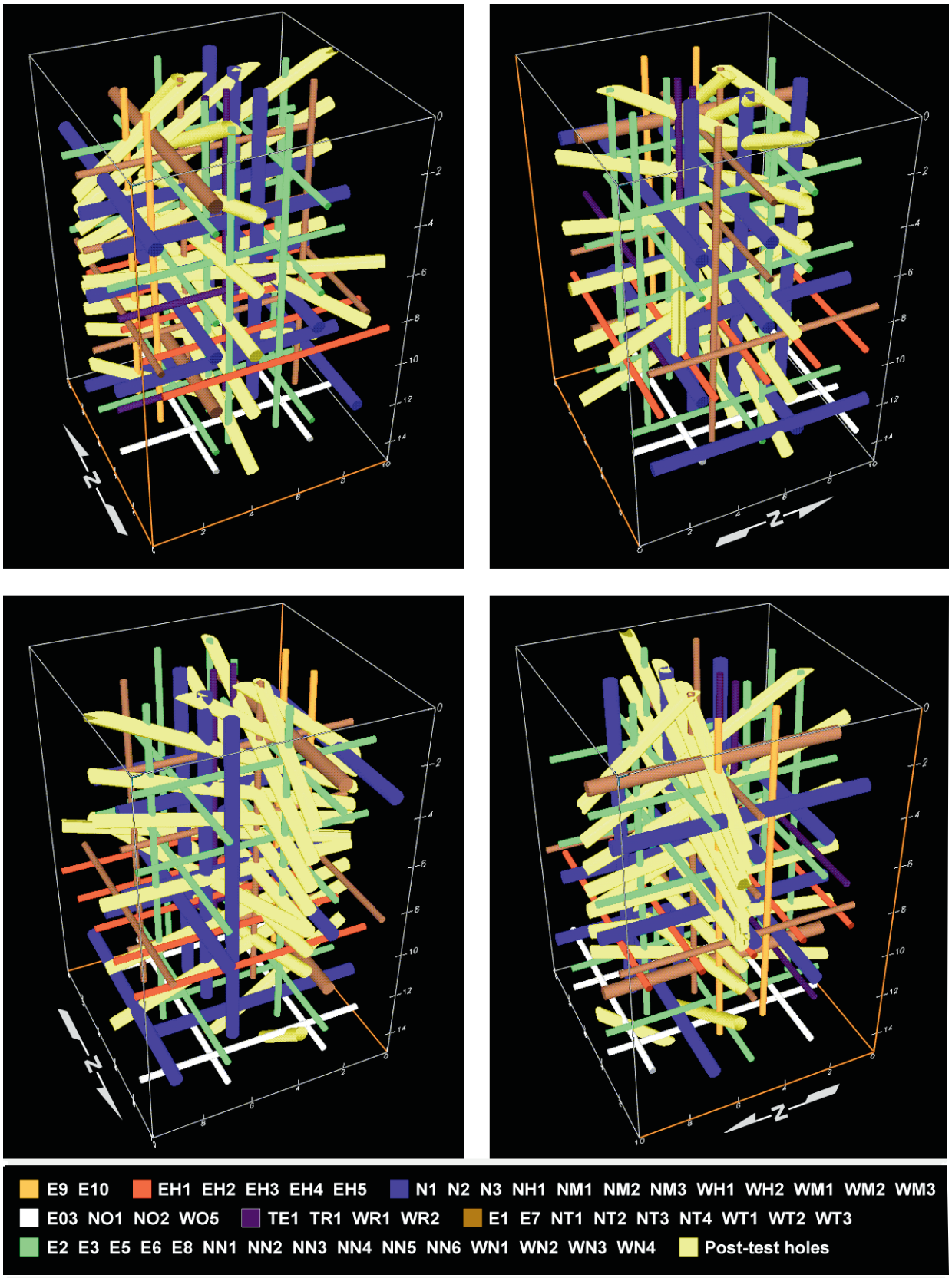

Figure 2. All boreholes in the large block: vertical and horizontal scales, in English units (ft), are equal and marked on the edges of the block.

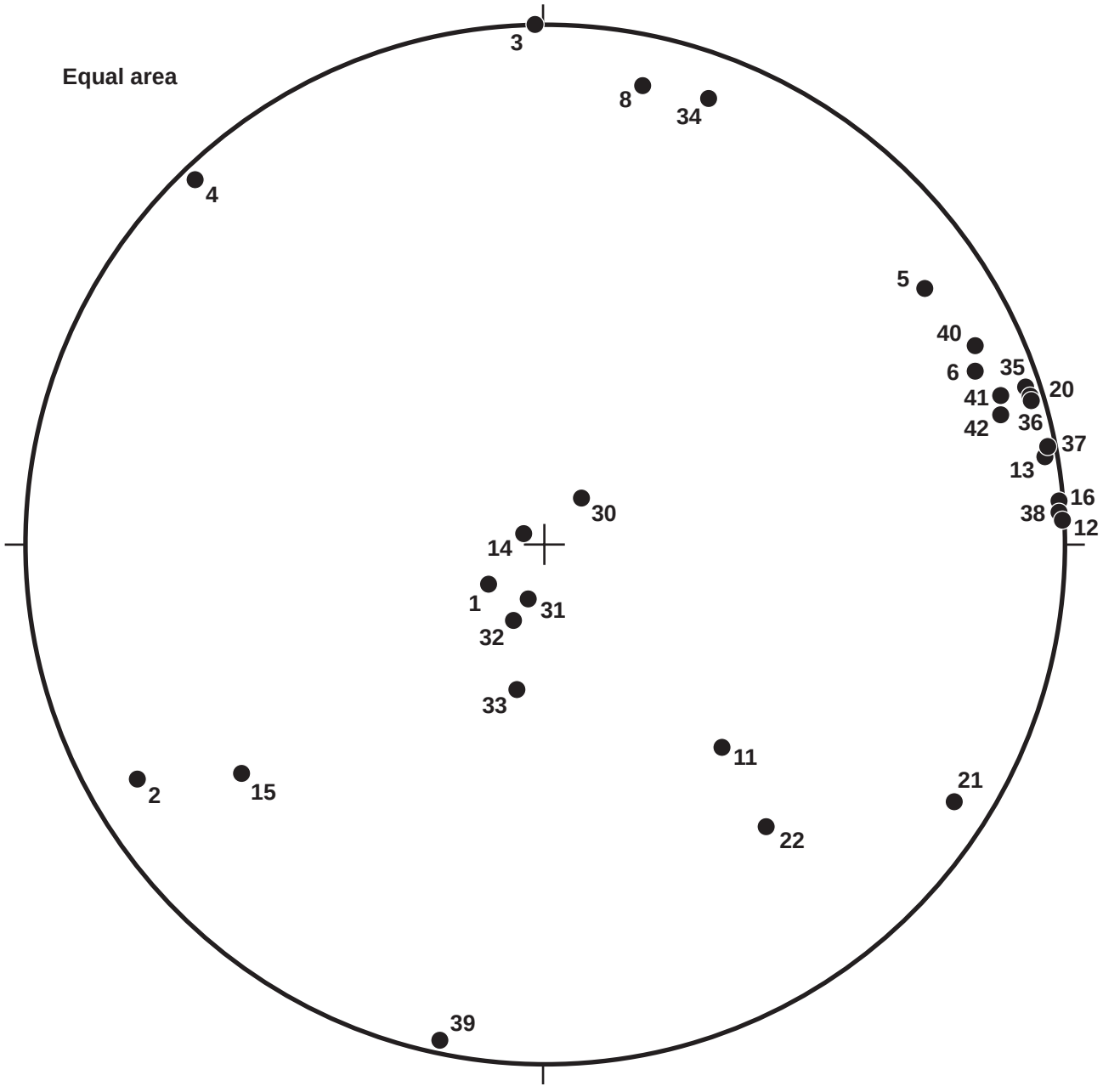

Figure 3. Equal-area diagram of poles to major fractures mapped for the LBT (Stereonet 4.9.5a by Richard Allmendinger of Cornell University in Ithaca, New York); fracture numbers correlate with fracture planes listed in Table 3

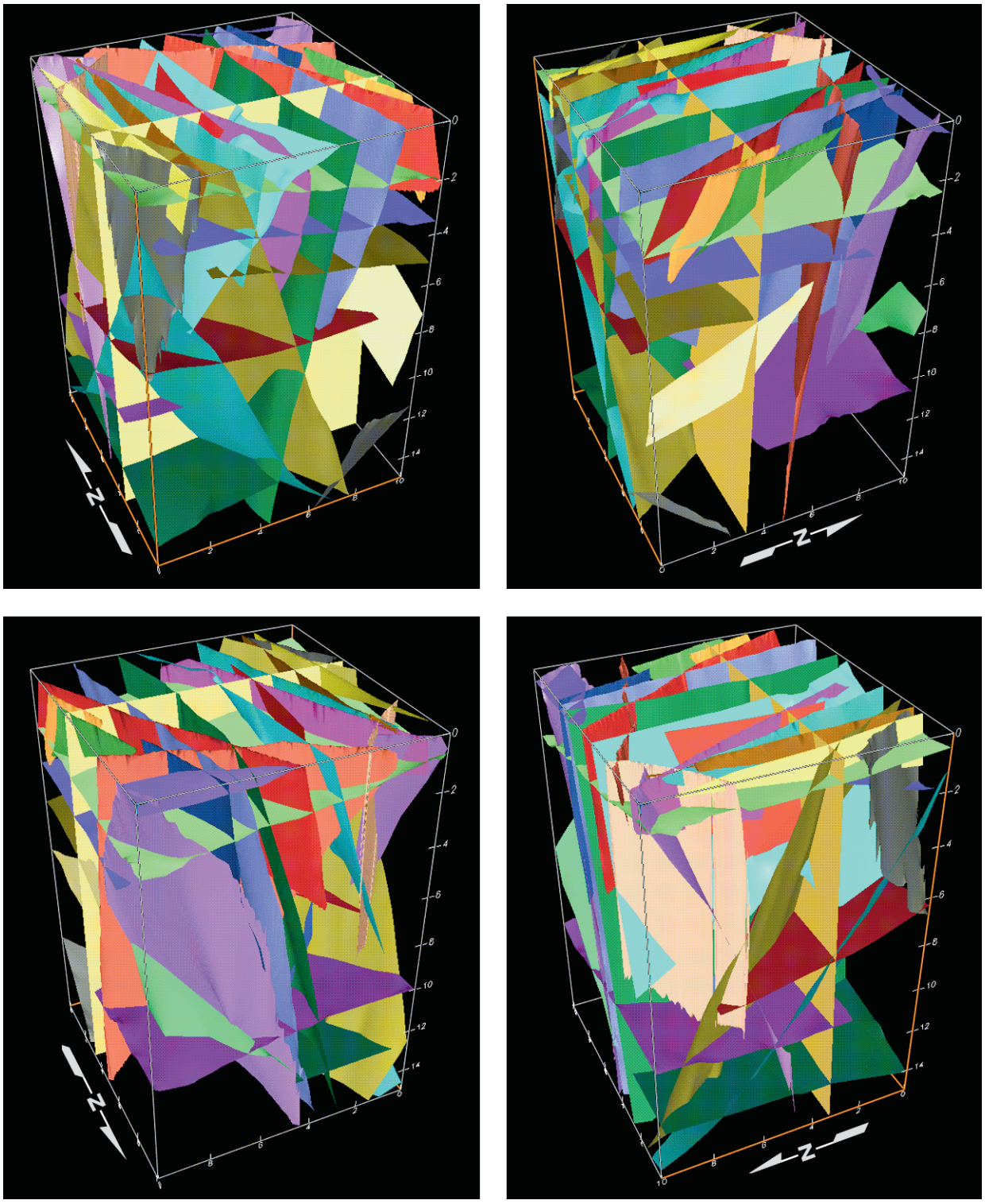

Figure 4. 3-D depiction of the major mappable fractures cutting the large block: individual fractures are color coded to facilitate discrimination of the fracture planes.; vertical and horizontal scales, in English units (ft), are equal and marked on the edges of the block.

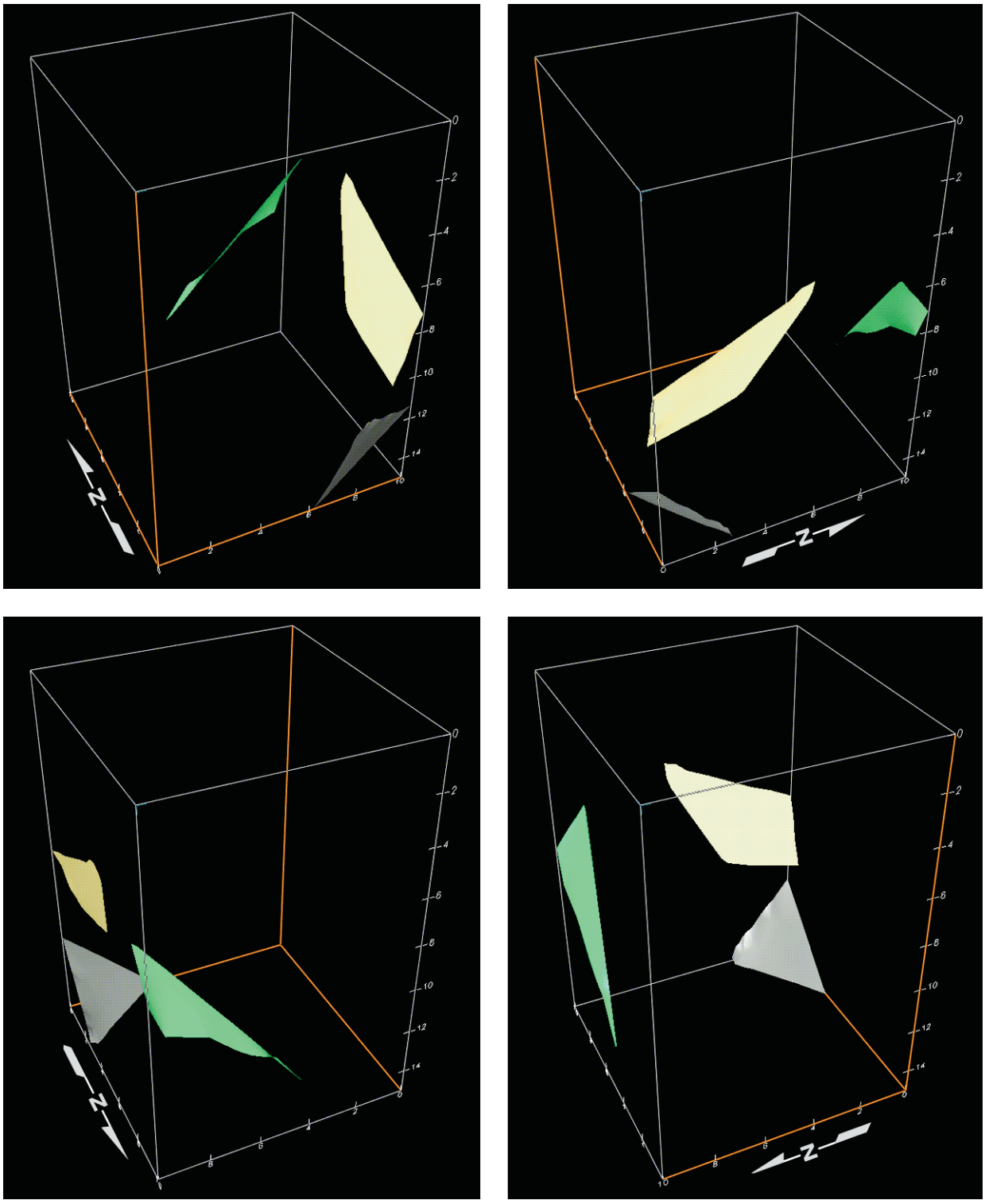

Figure 5. Fracture system #1 contains 3 fractures that strike N50E and dip 40–45° northwest: individual fractures are color coded to facilitate discrimination of the fracture planes; vertical and horizontal scales, in English units (ft), are equal and marked on the edges of the block.

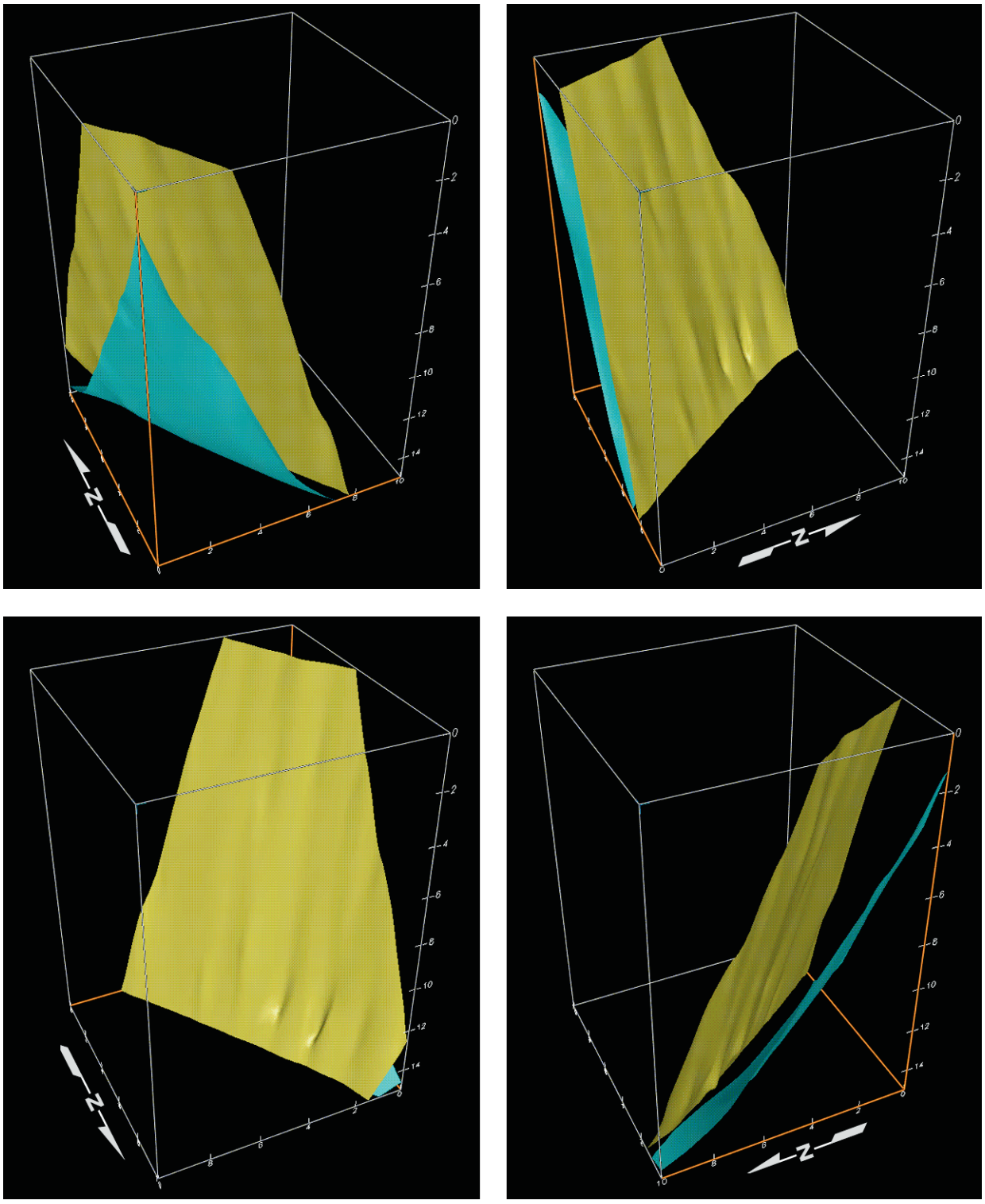

Figure 6. Fracture system #2 contains 2 fractures that strike N30–40W and dip 60–80° northeast: individual fractures are color coded to facilitate discrimination of the fracture planes: vertical and horizontal scales, in English units (ft), are equal and marked on the edges of the block.

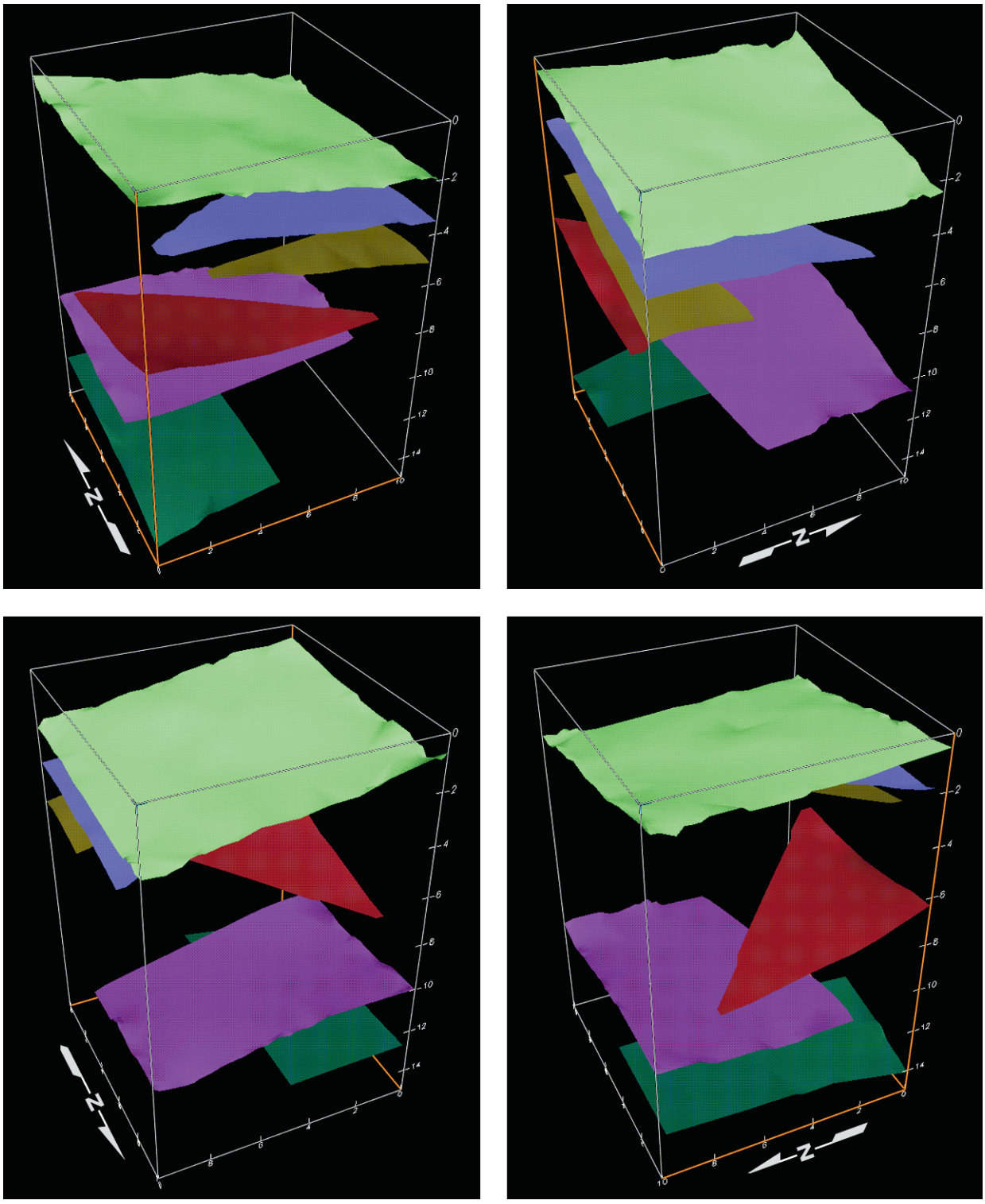

Figure 7. Fracture system #3 contains 6 subhorizontal fractures. Fracture LBT1 (green) is the largest, most significant fracture mapped in the block. Individual fractures are color coded to facilitate discrimination of the fracture planes. The vertical and horizontal scales, in English units (ft), are equal and marked on the edges of the block.

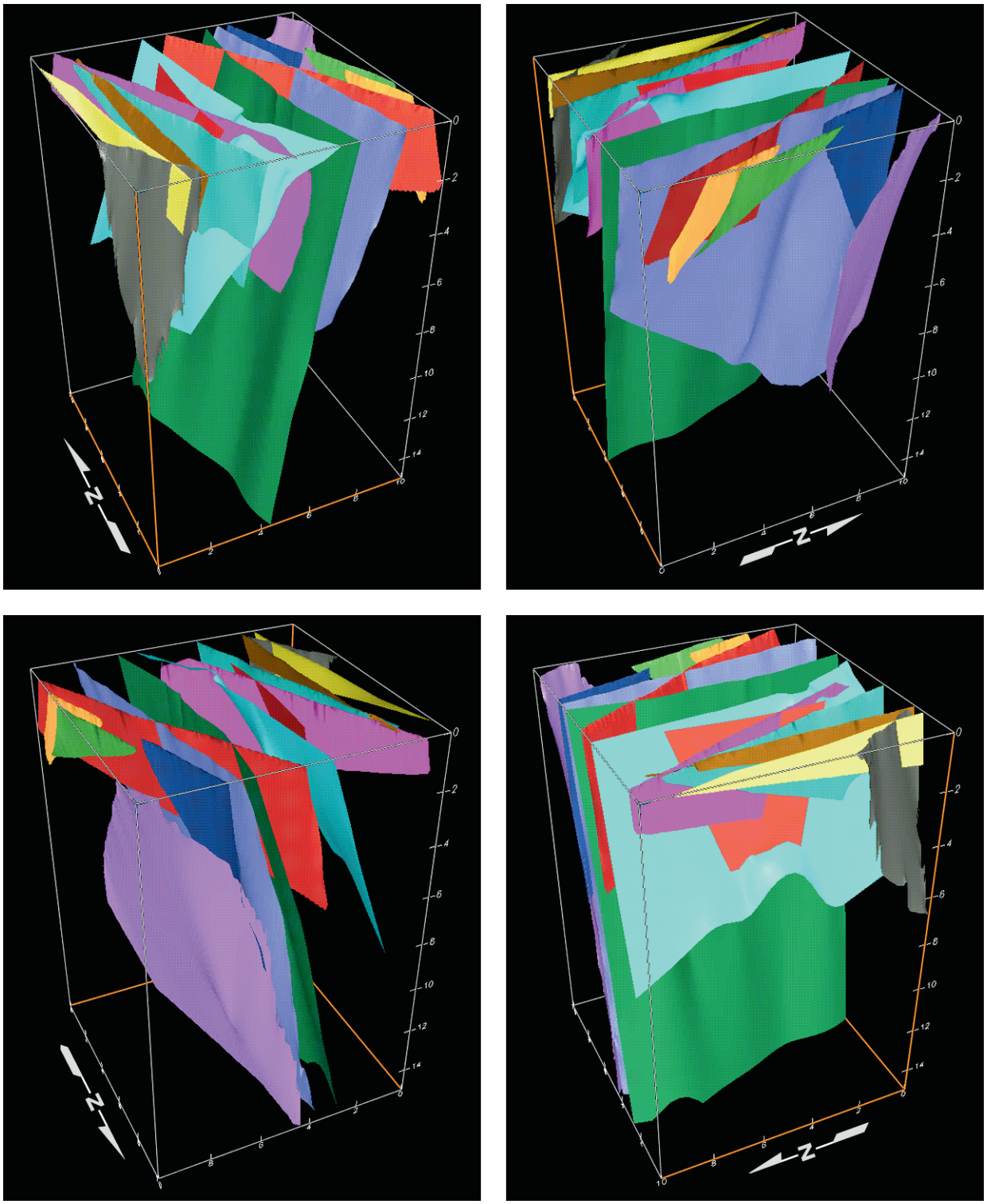

Figure 8. Fracture system #4 contains 13 mapped fractures and is the dominant system in the block. This system strikes northwest and dips toward the southwest. Individual fractures are color coded to facilitate discrimination of the fracture planes. The vertical and horizontal scales, in English units (ft), are equal and marked on the edges of the block.

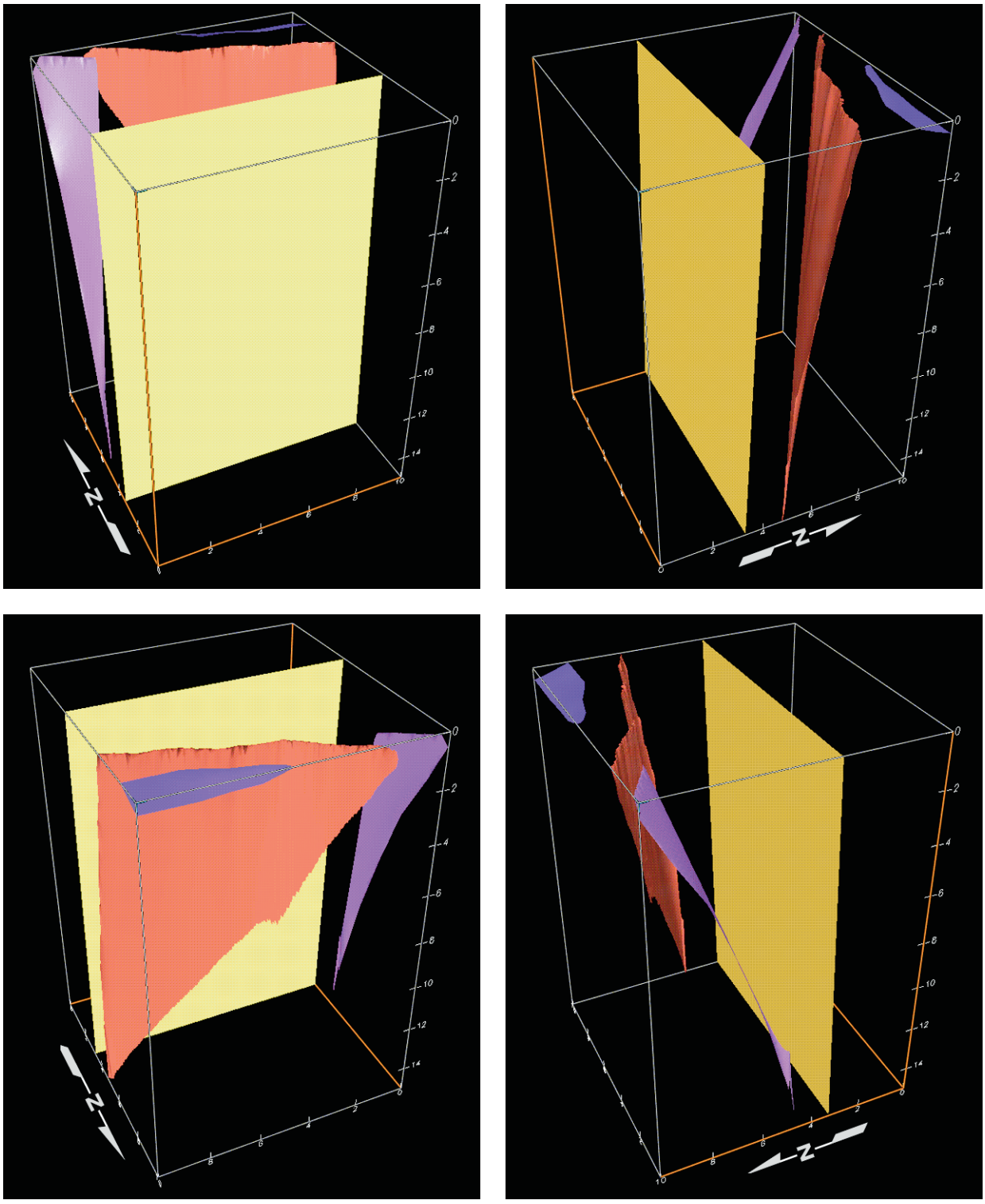

Figure 9. Fracture system #5 contains 4 approximately vertical fractures that strike east–west. Individual fractures are color coded to facilitate discrimination of the fracture planes. The vertical and horizontal scales, in English units (ft), are equal and marked on the edges of the block.

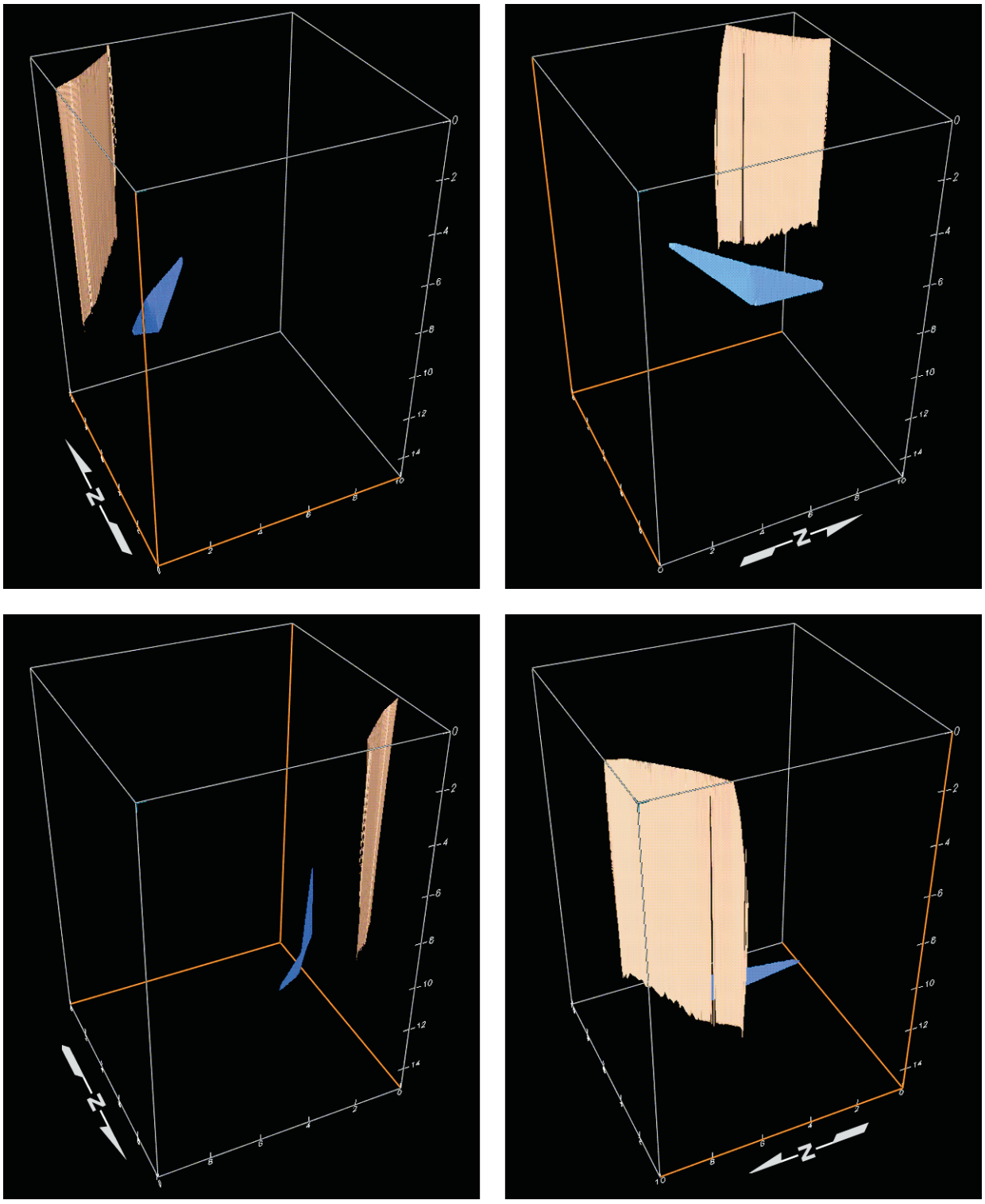

Figure 10. Fracture system #6 contains 2 mappable fractures that strike northeast and dip to the southeast. Individual fractures are color coded to facilitate discrimination of the fracture planes. The vertical and horizontal scales, in English units (ft), are equal and marked on the edges of the block.

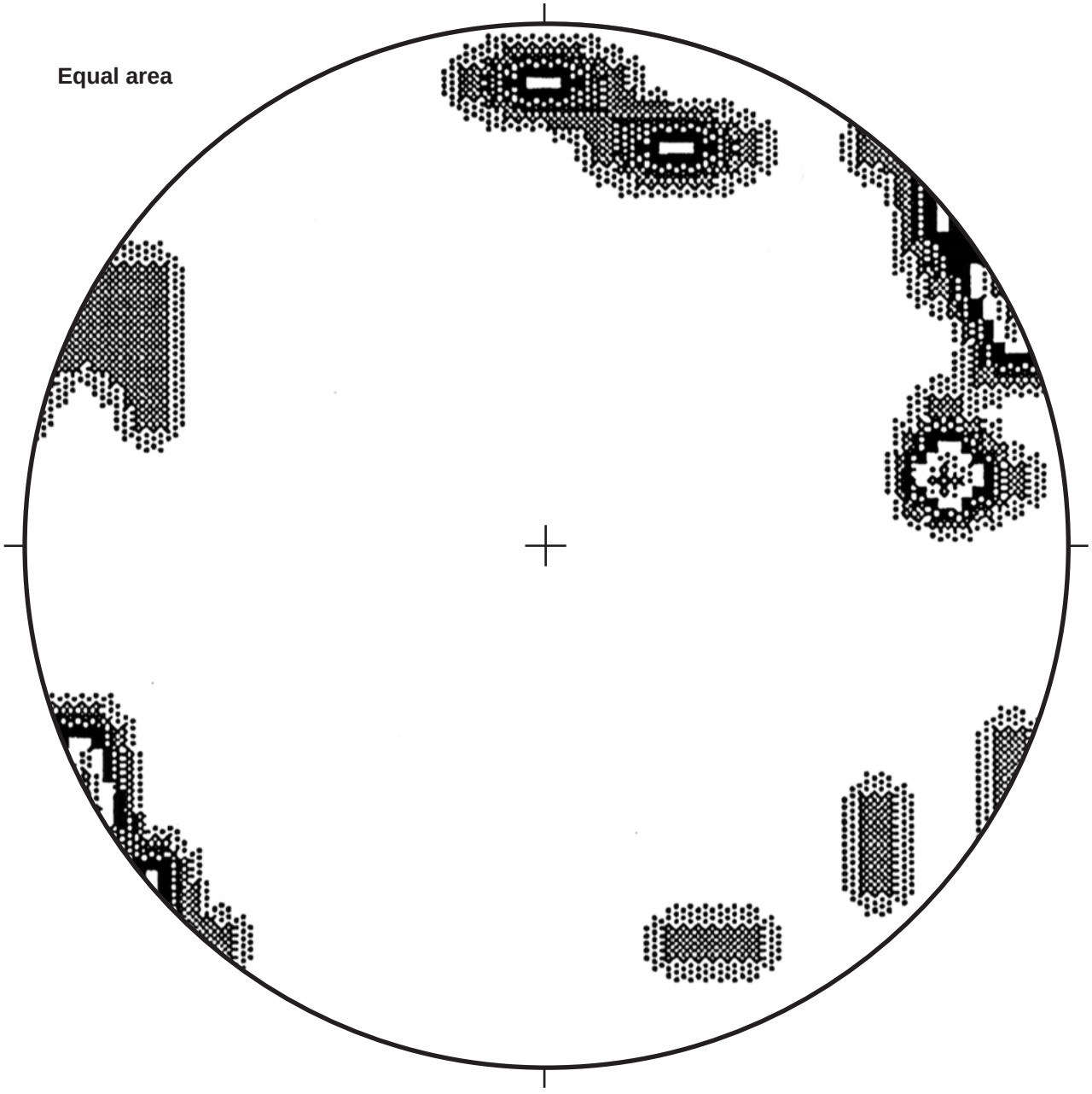

Figure 11. Analysis of fractures mapped after the top surface was leveled above the large block (Stereonet 4.9.5a by Richard Allmendinger of Cornell University in Ithaca, New York) (Wilder, et al., 1997, Section 2, Figure 2-13)

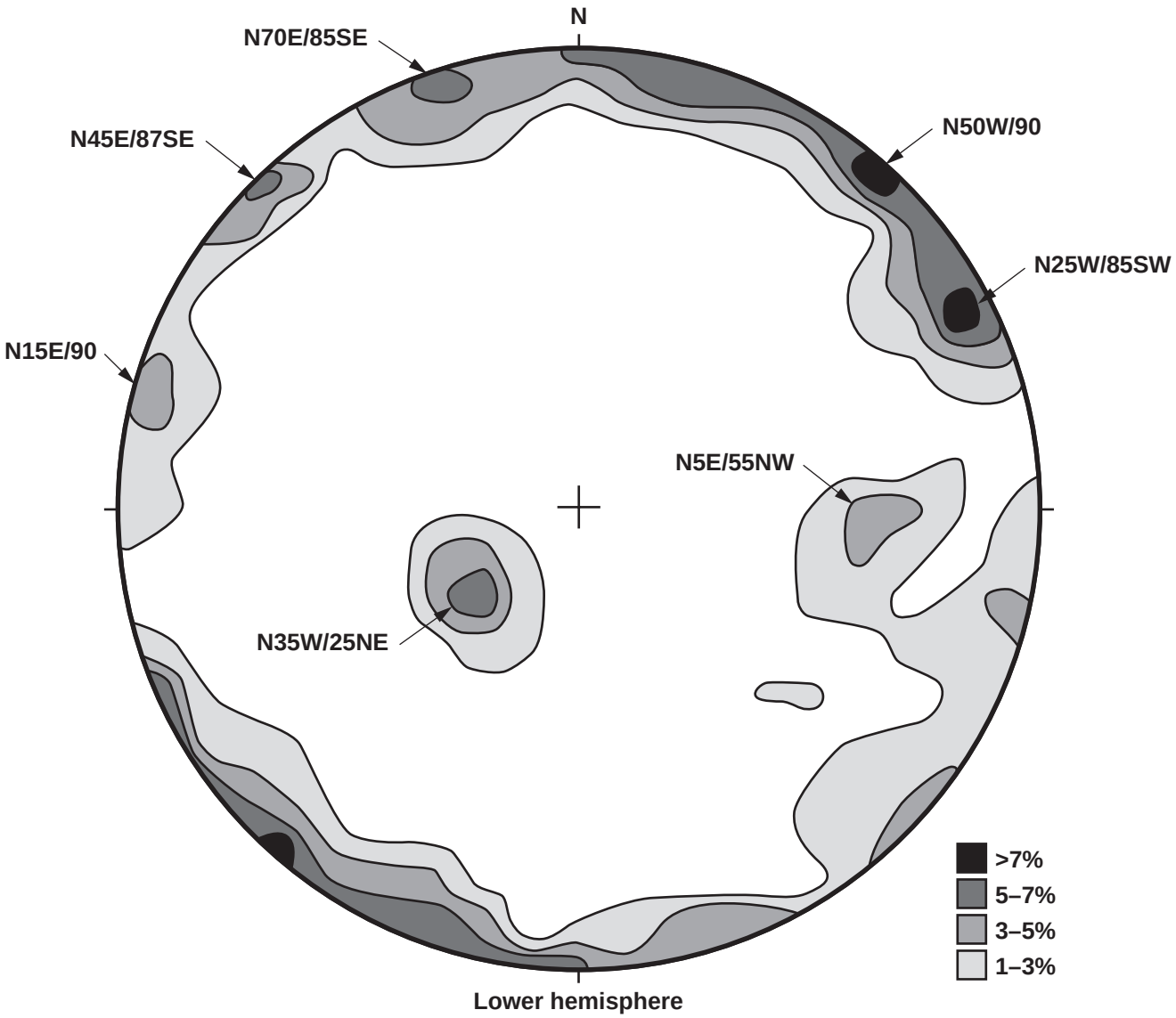

Figure 12. Equal-area contour diagram of poles to 90 fractures mapped in the Climax Stock granite (concentrations in percentage points within one percent area counting circle) (Thorpe and Springer 1981, p. 14, figure 6)

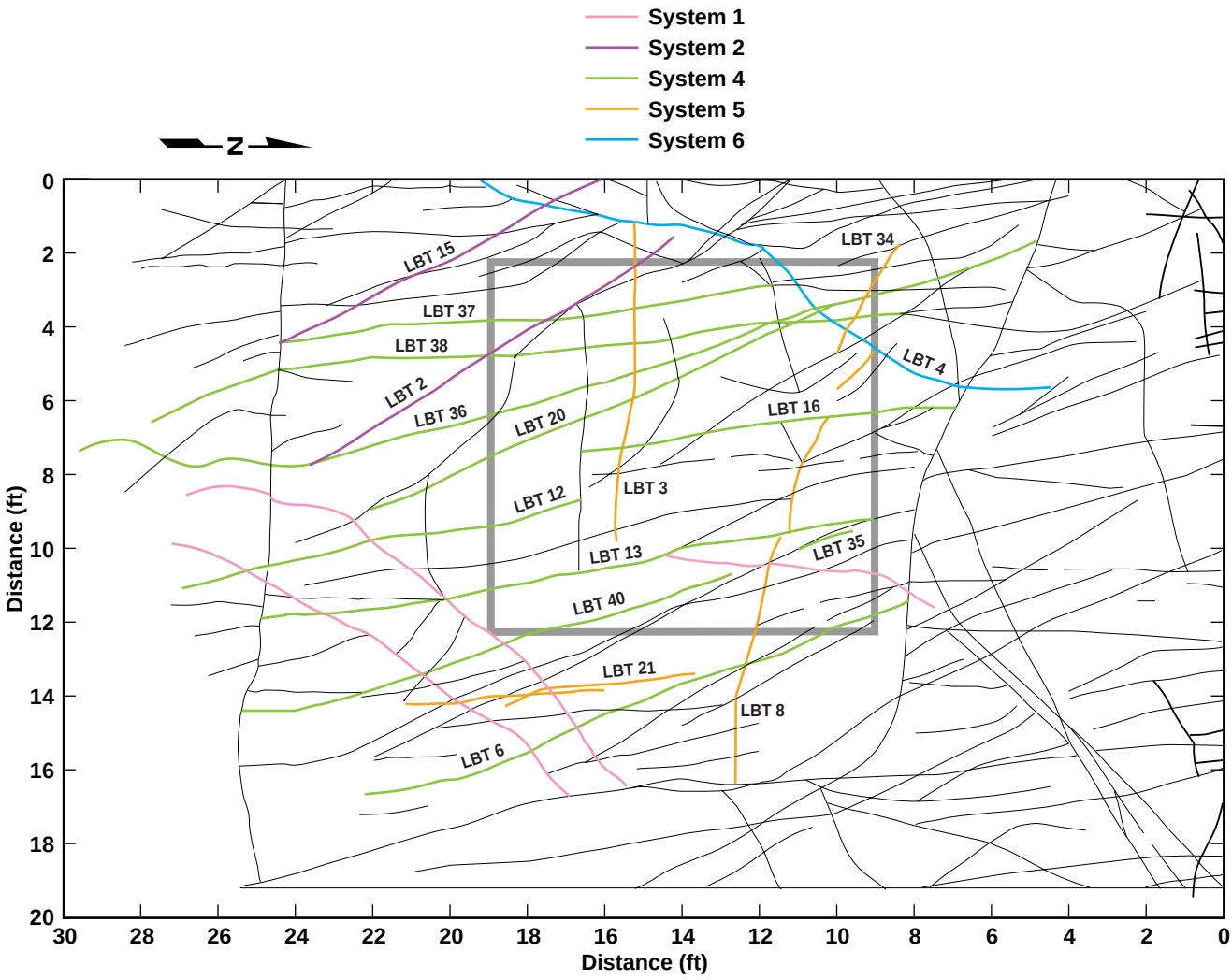

Figure 13. Fractures mapped at the Fran Ridge site prior to construction of the LBT (square): mapped LBT fracture systems were projected to this surface (color coded). (Wilder, et al., 1997, Section 2, Figure 2-1) The gray fractures were not correlated with named fracture surfaces in the block. Also, because of the lack of attitudes for these fractures, the gray fractures could not be specifically assigned to a fracture system.

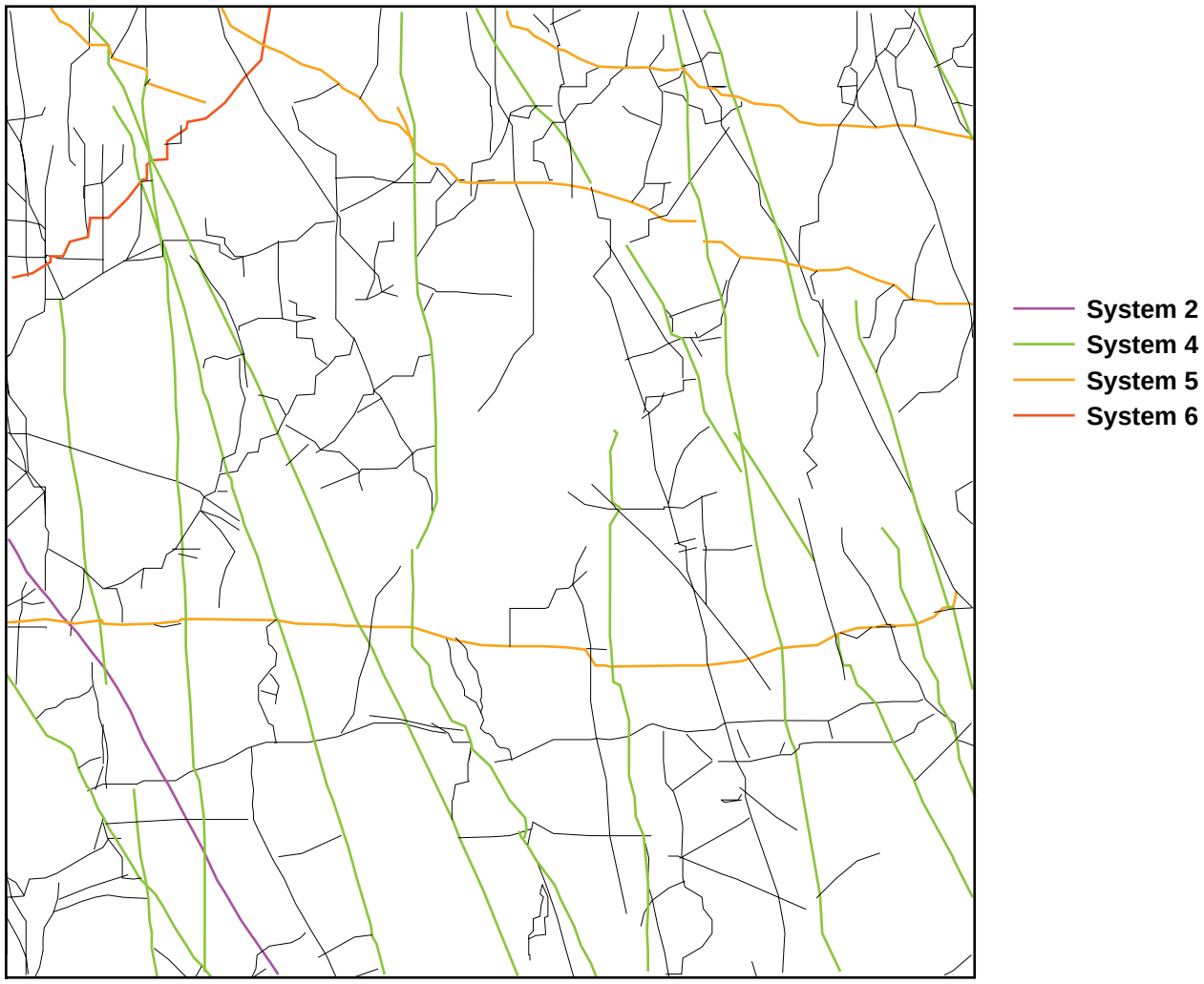

Figure 14. Mapped fractures on top of the LBT

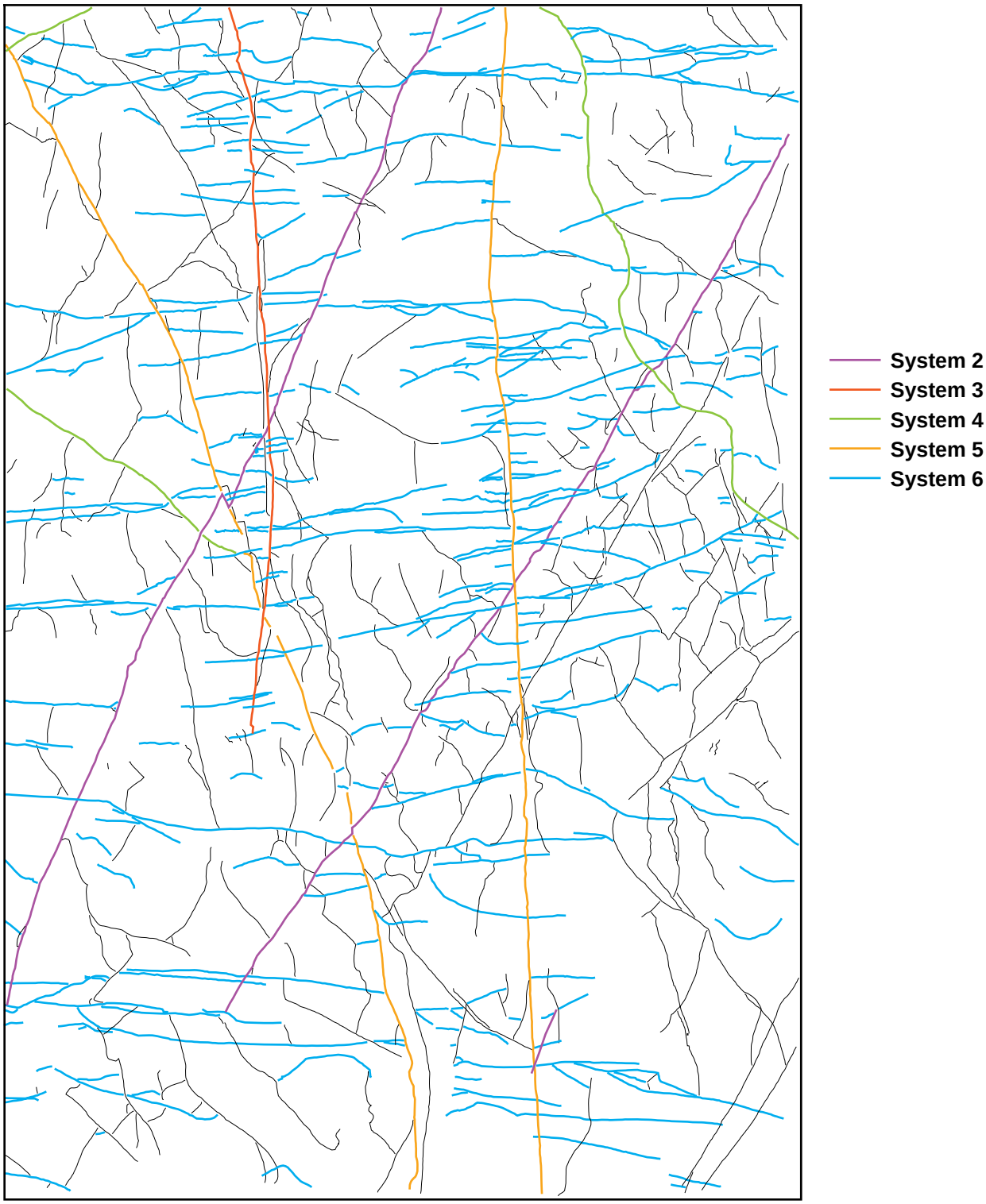

Figure 15. Mapped fractures on the west face of the LBT

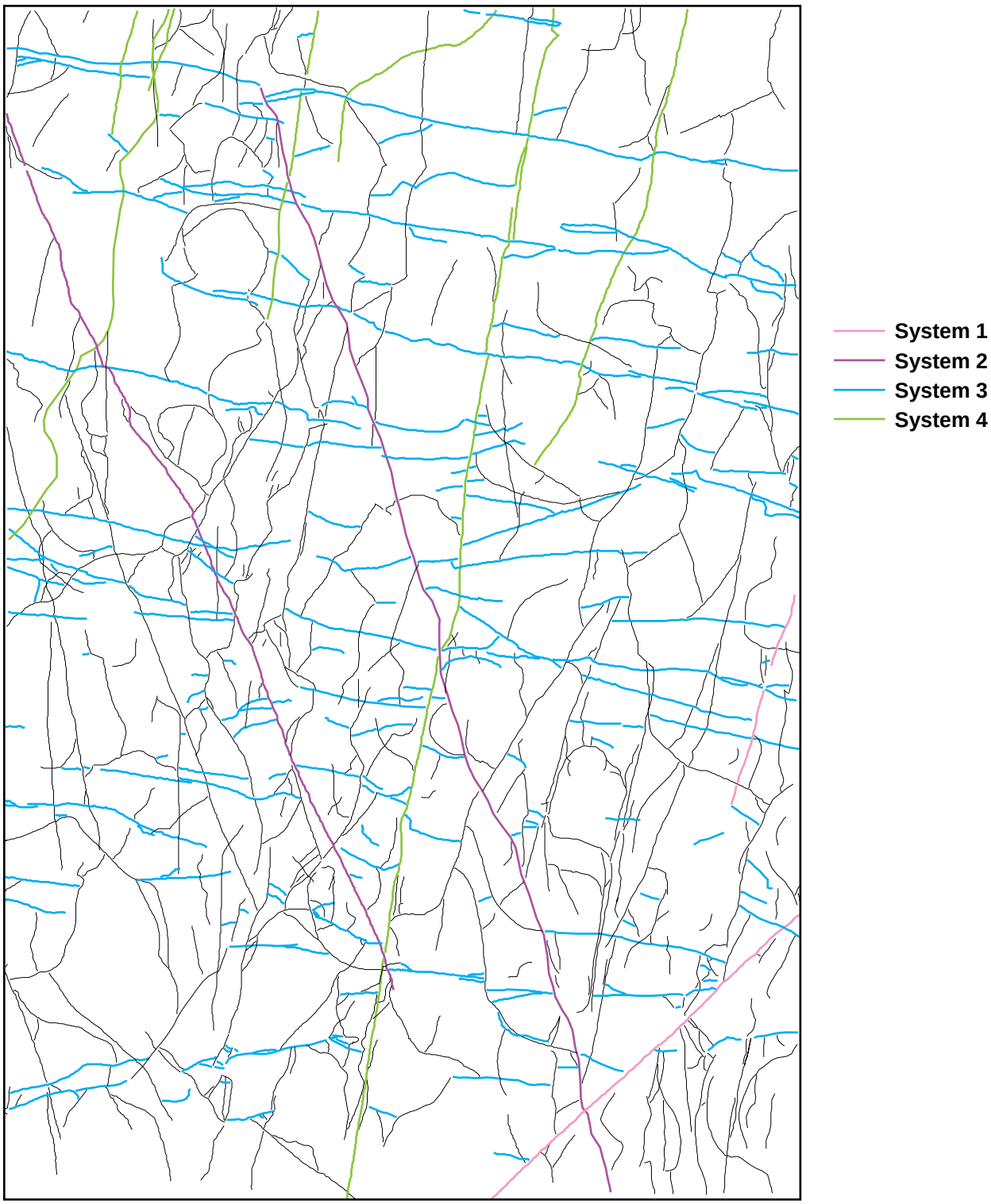

Figure 16. Mapped fractures on the south face of the LBT

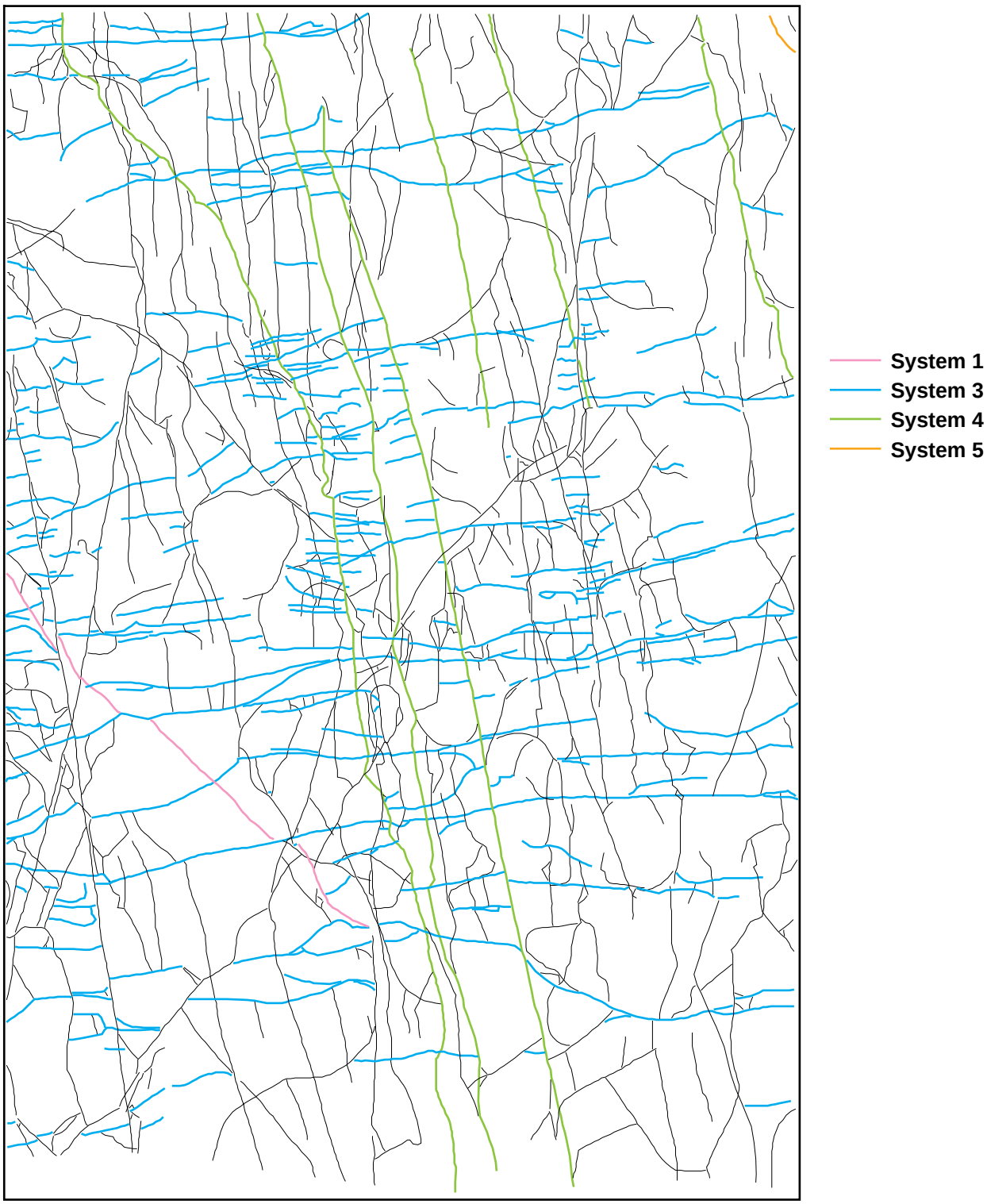

Figure 17. Mapped fractures on the north face of the LBT

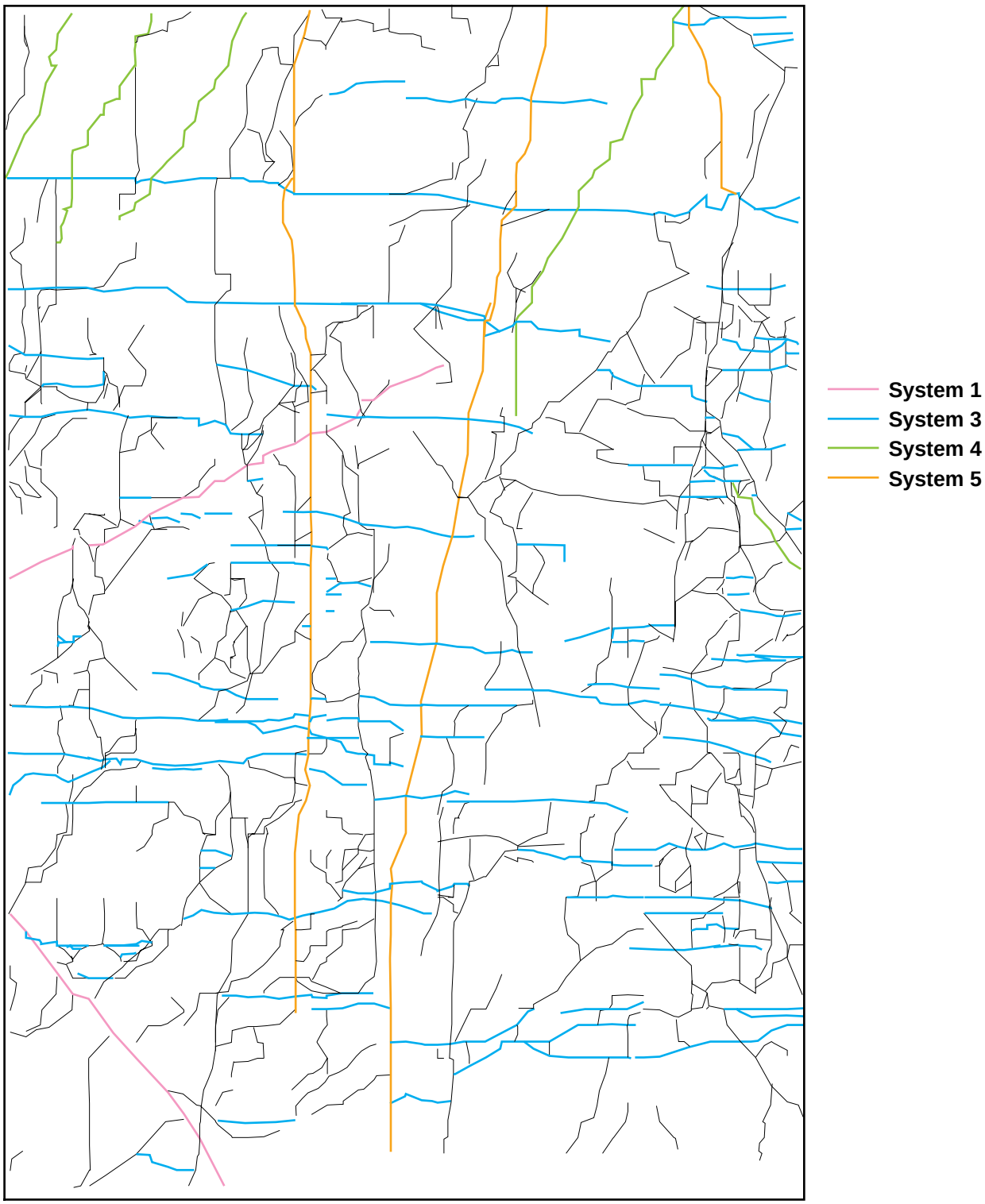

Figure 18. Mapped fractures on the east face of the LBT